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ABSTRACT

These hearings focused on House Resolution (H.R.) 1310, a legislative proposal incorporating H.R. 30 and H.R. 582. This proposed legislation has three main parts: (1) assistance to elementary and secondary levels of education to improve the quality of instruction and achievement; (2) postsecondary education assistance; and (3) a national policy on science and engineering manpower, and an engineering and science personnel fund for matching grants. Individuals presenting testimony and/or providing prepared statements for these hearings include: Carl Perkins; Paul Simon; William Goodling; Jon L. Mills; Craig Phillips; Joseph Pettit; Evelyn Handler (presenting views of the higher education community); James Gant (representing the American Association of Colleges for Teacher Education); Maryly Peck; Jon Fuller (representing members of the National Association of Independent Colleges and Universities); Timothy Worth; Robert Gillespie; Richard Van Horn; David Florio (representing the American Education Research Association); Don Dimancescu; Robert Finnell; Jerry Jasinowski; Jack Geils (representing the American Society of Engineering Education); and Bill Aldridge (representing the National Science Teachers Association and other professional science teacher organizations). Included (in an appendix) is a letter from Bruce Christenson (president, National Public Television), a statement from the National Education Association, and additional material submitted for the record. (JN)

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H.R. 1310, EMERGENCY MATHEMATICS AND SCIENCE EDUCATION ACT

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HEARINGS

BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST SESSION

FEBRUARY 9, 16, 1983

[No. 99]

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H.R. 1310, EMERGENCY MATHEMATICS AND SCIENCE EDUCATION ACT

WEDNESDAY, FEBRUARY 9, 1983

House of Representatives,
Committee on Science and Technology,
Washington, D.C.

The committee met, pursuant to notice, at 9:10 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the committee) presiding.

Present: Representatives Fuqua, Brown, Walgren, Volkmer, Nelson, Lundine, McCurdy, Dymally, Simon, Mineta, Durbin, MacKay, Valentine, Reid, Torricelli, Winn, Walker, Sensenbrenner, Gregg, Skeen, Schneider, Lowery, Chandler, Boehlert, McCandless, Lewis, and Bateman.

The Chairman. The committee will be in order.

The Committee on Science and Technology meets today on the critical issue of science, engineering, and mathematics education and personnel.

The quality of science and mathematics education at every level of our education system has a profound effect upon our Nation's economic vitality and national security. This is one of the most fundamental problems our Nation faces and one of the most important topics on the legislative agenda of the 98th Congress.

Since 1979, the Science and Technology Committee has dealt extensively with the issues of science, engineering, and math education and personnel. Respected engineers and scientists from throughout the country have testified on the nature and scope of the problem we now face.

Last year the committee approved the bill, H.R. 7130, the National Engineering and Science Manpower Act, along with other provisions of H.R. 7130, which provided for a national policy on engineering, technical and scientific manpower and established an engineering and science personnel fund. Unfortunately, there was not enough time remaining in the 97th Congress to take final action on that bill.

At the start of this Congress, I introduced H.R. 582, a bill to provide a national policy for scientific and technical personnel and to establish a fund as envisioned in the bill, H.R. 7130, of last year.

Earlier this Congress, our colleagues in the Education and Labor Committee began work on a bill introduced by Chairman Perkins, H.R. 30. Several sessions of hearings were held in the Education and Labor Committee.

Today we join our colleagues on the Education and Labor Committee, under the able leadership of Chairman Perkins, in building a new legislative proposal, H.R. 1310, incorporating H.R. 30 and H.R. 582.

H.R. 1310 has three major parts: Assistance to elementary and secondary levels of education in order to improve the quality of instruction and achievement; two, the postsecondary education assistance; and, three, a national policy on science and engineering manpower, and an engineering and science personnel fund for matching grants.

H.R. 1310 has been jointly referred to the Committee on Science and Technology and the Committee on Education and Labor, and our colleagues on the Education and Labor Committee have already approved H.R. 1310. After this committee takes action, Speaker O'Neill intends to bring the bill to the floor just as soon as possible, probably during the week of February 21.

In mutual recognition of the crisis in science and math education, our two committees are working together to forge a responsive proposal. As part of that cooperation, I, and four other members of the Committee on Science and Technology testified before the Committee on Education and Labor. We will continue in this spirit of cooperation as we work toward the final action on H.R. 1310.

I want to welcome my colleagues from the Committee on Education and Labor and thank them for their fine contributions in this area.

I recognize Mr. Gregg.

Mr. GREGG. Mr. Chairman, I appreciate your recognition of me. Mr. Winn was going to try to make it this morning, but he has asked me to address a couple of issues which the minority must raise, I believe, in order to clarify the situation.

We have before us today a bill which I think is very important. As the ranking member on the Science, Research and Technology Subcommittee, I have had the pleasure of working with Chairman Walgren, who has been very committed to this issue. We feel very strongly that this is an area where this Congress must dedicate considerable resources, and in fact this bill has dedicated considerable resources. I quite honestly have no problem with the money figure which this bill is talking about. But it must be dedicated in a professional and effective manner.

The problem that we have on the minority is that we have not received any warning of how this is going to proceed. We have received a bill today which is House Resolution 1310, put before us. This bill, as we understand it, is not the bill that was actually marked up or is to come before this committee.

It has, as you have referred to, three basic sections. The first section, which I guess is the prerogative of the House Education and Labor Committee, has some problems, we feel, in the area of lack of targeting, in the area of the fact that it overlaps activities that the NSF has already undertaken. But that section is not our area of responsibility.

However, in the areas where we do have responsibility, this bill talks in terms—in part B—of congressional scholarships. Now, I understand that Mr. Simon is going to introduce, or has already introduced—we just do not know because we have not received the material—an amendment which would change this whole congressional scholarship approach. Furthermore, we would no longer have the outline as presented before us on 1310, so we really do not know what we are being presented with here today, whether Mr. Simon has an amendment or whether an amendment has been proposed. We have heard that there is language around that affects that.

Continuing, the bill 1310 which we have in front of us does not talk in terms of a supplemental language, although I understand that maybe the bill that came out, or maybe there is a bill floating around here which talks in terms of supplement versus replacement dollars. The minority are very concerned that these dollars be spent not as replacement dollars but as supplemental dollars, and we understand that that language may have been taken care of, but we do not have the language before us today that outlines that, so how can we address it? Of course, we did not get any language until late last night, to begin with.

The third section gets into the area where we clearly have responsibility as a committee, and this is on the issue of title II, the national education and science personnel section. In this area, we as a minority, have some very serious reservations about the language, because it is a very unstructured proposal. It is talking about giving $100 million to the National Science Foundation—which we think it can use and it probably should have—but it does not direct the National Science Foundation in any formal way as to how to spend that money. In fact it has no direction at all, and the money could be spent on innumerable activities which may have no relationship to our fundamental concern, which is the retraining and expansion of abilities within the math- and science-teaching faculties of our secondary and elementary schools.

This is an emergency bill, as titled, and as an emergency bill, it should be targeted, in my opinion, and in fact, there is no targeting in this entire bill. Specifically, we understand that one of the amendments to the congressional fellowship program may call for it to even be used for foreign language education, which is obviously a need in this country but is not a math-science need.

So I would say, as a minority member and as a member who has had some experience with this issue, that the bill is hastily drafted at best; that it comes before us in a very unusual circumstance, because it comes before us without us having any hearings at the subcommittee level; that we do not have the bill at all that I suspect we are going to end up with before us, even though we are being told to go forward with that bill; and that we really have been treated rather shabbily as a minority in being advised as to what the whole process is that is occurring here.

This seems to me to be unfortunate, because as the minority we have already expressed our sincere interest in and our commitment to trying to do something in the area of math-science education. In fact, we have some very substantive proposals in this area, and we are not talking funding issues here. We are basically in agreement that the money must be spent. What we are talking about is spending the money effectively and efficiently.

We have a proposal which last year was known as the Schmitt-Heckler bill which had a targeting of the money which would have been spent on the issue of retraining teachers, which is our basic concern. But to bring forward to us, basically in the middle of the night, and tell us that we are going to pass instantaneously, a bill on what is one of the most important issues that this country has to face up to, which is the retraining and education of math and science teachers at the elementary and secondary school level, totally fails, in my opinion, to fulfill the responsibilities of the majority party in this House, especially when the minority party has already acknowledged that we are willing to work with you on this matter.

And so I just address this committee and say, gentlemen and ladies, really, we must take some time to develop this proposal in an honest, effective, and efficient way, because we are willing to do it as a team. But to go forward in this manner, the way this bill has been brought up, really is not fair to us, and I do not think it is fair to the science and math communities in this country, and it is certainly not fair to this country which needs to have the basic resource of a well-trained, intelligent youth on the issue of math and science.

Thank you.

Mr. Walker. Mr. Chairman.

The Chairman. Mr. Walker, Mr. Perkins does have a time problem, and we are not planning to markup the bill today. So we would like to get Mr. Perkins in if we possibly could.

I think you can stay, can't you, Mr. Simon?

Mr. Simon. Yes, though I have a 9:30 subcommittee that I am chairing and I should be at, but I am sure somebody else can be there.

Mr. Walker. Mr. Chairman, I would certainly accede to their wishes if we are not going to take any more statements, but I would like to reserve the ability to make a statement once these witnesses have finished.

The Chairman. Certainly.

Mr. Walker. Thank you, Mr. Chairman.

Mr. Walgren. Mr. Chairman, if I might also reserve at this point in the record an opening statement.

The Chairman. The Chair will protect the gentleman's right.

Mr. Nelson. May I, too, Mr. Chairman?

The Chairman. All members will be protected.

Mr. Walgren. All right, fine.

[The opening remarks of Mr. Walgren and Mr. Nelson follow:]

Opening Remarks of Representative Walgren, Hearing before Committee on Science and Technology on H.R. 1310, February 9, 1983

Mr. Chairman, the crisis facing us in science and mathematics education is real and requires emergency action. The Committee on Science and Technology is meeting today to hear our colleagues on the Education and Labor Committee as part of a cooperative effort to develop a bill addressing the need to improve science and math education in this country.

H.R. 1310 is a solid start in the effort to match the realities of a rapidly changing technological environment with the manpower and citizenry needed to work and function in tomorrow's economy. Economically and socially we cannot afford to allow a majority or even a substantial fraction of our people stand on the sidelines as technology goes forward at an ever increasing rate.

In hearings conducted by the Subcommittee on Science, Research and Technology, we listened to educators and scientists of national renown describe the problems in science and math education as they deal with them on a daily basis. There can be no doubt of the existence of the problem and the critical necessity to deal with it.

There are several points about the situation in math and science and math education that strike me as among the most important. First, the quality of math and science instruction must be strong in primary and secondary schools; second, colleges and universities desperately need teachers and researchers who will sustain the production of engineers, scientists and technical personnel for the future; third, we need to draw on the experience and expertise of private industry and share resources with our schools.

H.R. 1310 attempts to use the strengths of both the National Science Foundation and the Department of Education in addressing these needs.

I welcome the administration's interest in this area and look forward to intensive consultations with all members of this committee and the Education and Labor Committee in developing a comprehensive bill addressing all facets of this problem. It is important that we reach an agreement with all interested members and produce a product that this Congress can be proud of.

Statement by Bill Nelson for Science and Technology Hearing on Mathematics and Science Education Bill—H.R. 1310

Mr. Chairman, I am pleased to have this opportunity to speak in strong support H.R. 1310. I am a cosponsor of this legislation which is a combination of two bills—the Emergency Mathematics and Science Education Act and the National Engineering and Science Personnel Act. I was originally a cosponsor of each of these vital bills also. This hearing today is an important step in securing a speedy enactment of this important legislation.

The global economy of the 1980's will be one of high technology in homes, schools, businesses and government services. Today, the United States is a world technological leader primarily as the result of our national resource of skilled scientists, technologists, engineers and technicians. This leadership is essential for our economic and national security.

U.S. technological supremacy has eroded as other industrial counties have developed and implemented programs for expanding their technological capability. Our technological edge is threatened by a shortage of skilled engineers and scientists and, even more seriously, by the lack of general scientific and mathematical literacy necessary for the majority of citizens who provide the technical and consumer support of our economy. Technological literacy is also becoming increasingly important for full participation in our society and for individual personal development.

Our future national economic and social well-being is written by our schools and their ability to prepare youth for effective participation in a technological, information society. There is increasing evidence that the mathematical and scientific literacy of our youth and adults is being neglected.

If we are to respond effectively it is essential that we:

Establish the improvement of education and mathematical and scientific literacy as a priority for action;

Increase and improve the pool of qualified teachers of mathematics and science who can adequately prepare our youth for the emerging technological society;

Restructure and revise the mathematics and science curriculum to prepare the nonspecialist as well as the specialist and to modify the sequencing of curriculum to match the stages of intellectual development and ability;

Increase the amount of time students spend on academic studies and increase the availability of scientific equipment and facilities;

Develop comprehensive programs that can further general computer literacy, including computer applications that will lead to increased mathematical and scientific literacy.

This legislation is an important first step in addressing our current crisis. Our leadership in technology for the world is at stake. We cannot afford to wait any longer.

I commend Mr. Perkins, Mr. Simon, and Mr. Goodling from the Education and Labor Committee and my chairman, Mr. Fuqua, Mr. Walgren and Mr. McCurdy for their insight in bringing this legislation before us in such a timely manner. I urge its passage as soon as possible.

The Chairman. Mr. Perkins, we are happy to have you here.

STATEMENT OF HON. CARL PERKINS, A MEMBER OF CONGRESS FROM THE STATE OF KENTUCKY AND CHAIRMAN, COMMITTEE ON EDUCATION AND LABOR

Mr. PERKINS. Mr. Chairman and members of the committee, first let me state that I have a full committee hearing ready to commence at this time, with the president of the United Mine Workers and the president of the Coal Operators of the United States waiting for me to start the hearing. But I will be delighted to return sometime later today to answer any questions that Mr. Gregg may have.

I have dealt with mathematics and science education since 1948, when we passed the National Defense Education Act, after Sputnik was put up, with the hope that we could keep ahead of the Russians insofar as our technology is concerned. I think the bill worked well for several years.

Then we broadened the National Defense Education Act, including the student assistance and higher education programs, to make this assistance available to more people. Millions and millions of young people have taken advantage of that very worthy program, in my judgment.

I think that in the last several years, science and math have been lagging, and that is the purpose of this bill today.

I want to say that I have had the utmost cooperation with the chairman of this committee, Mr. Fuqua. In no way do we want to tell you how to write your science aspects of this bill. We did not even touch it in our committee yesterday. We felt that was your jurisdiction and that you should make whatever changes in that area you feel are necessary.

H.R. 1310 consists of two titles. Title I consists of the text of H.R. 30, the Emergency Math and Science Education Act that I introduced along with Congressmen Simon and Goodling, on January 3. Title II consists of Mr. Fuqua's bill, H.R. 582, the National Engineering and Science Personnel Act of 1983.

H.R. 1310 has been jointly referred to the Committee on Education and Labor and the Committee on Science and Technology. However, Chairman Fuqua and I have agreed that the elementary and secondary education programs, part A of title I, are exclusively in the jurisdiction of the Committee on Education and Labor, and that title II, the National Science Foundation programs, are exclusively in the jurisdiction of the Committee on Science and Technology.

Part B of title II presently contains postsecondary education programs in which both of our committees have an interest.

I wish to emphasize that title I contains two parts. Part A authorizes an elementary and secondary education formula grant program to improve mathematics and science education. These grants would be allocated to all the States and local school districts and would be administered by the Department of Education. The elementary-secondary part authorizes $250 million for grants to States on a formula basis.

The State educational agencies are required to pass through at least 75 percent of their funds to local school districts, and the

States may retain up to 25 percent of the funds for State-level programs.

The main purpose of both the State and local education programs would be to improve in-service teacher training in mathematics and science. Funds could also be used for other activities to improve, modernize, or expand elementary and secondary instructional programs in mathematics and science.

Part B authorizes post secondary programs to enhance teacher preparation in mathematics and science. These programs include merit scholarships, summer institutes, postsecondary instructional improvement, and research. Your committee may wish to consider part B and make recommendations for additions to these programs, based upon your knowledge and understanding of science programs at the higher education level. The present authorization is $50 million for fiscal 1984.

Of course, I trust your committee will thoroughly consider title II and amend it as you see fit, given your expertise in the National Science Foundation programs.

Yesterday the Committee on Education and Labor ordered reported H.R. 1310 by a vote of 27 ayes and 3 nays. Our committee markup dealt exclusively with title I of the bill. I feel the Education and Labor Committee produced a sound bill with bipartisan support that directly addresses the needs of this country for mathematics and science education.

And I look forward to working with this committee and your chairman, Mr. Fuqua, in bringing a good bill to the floor as soon as possible to deal with this severe problem.

The majority leader this past week told me the bill would be up next Tuesday, and I think we conveyed that to your committee, but I was informed yesterday by your committee that the bill had been delayed. We did not waste any time getting the bill reported from our committee, but we did consider it thoroughly, I think.

Lastly, let me thank all the members of the Committee on Science and Technology who came before the Committee on Education and Labor to testify on this legislation. The testimony of these members was extremely valuable, so I would like to thank the following members for appearing: Chairman Don Fuqua, Congressmen George Brown, Doug Walgren, Dave McCurdy, and Mervyn Dymally.

That is my statement. If you want me to come back here sometime today, I will be glad. I will be delighted to do that.

The CHAIRMAN. How long will your hearing last today, Mr. Perkins?

Mr. PERKINS. I would think about 2 hours, or 2½. I hate to keep the president of the Coal Operators, the National Coal Association, waiting, and the president of the United Mine Workers. They are both waiting down there now.

The CHAIRMAN. Mr. Walker had a question he wanted to ask.

Mr. PERKINS. All right. Go ahead, Mr. Walker.

Mr. WALKER. I appreciate that, Mr. Chairman, and I thank you for just a question, Mr. Chairman.

Why is this thing on such a fast track? You know, this is not the lame-duck session any longer. We have a little time to consider these things and consider them well. Why is the majority leader scheduling this for next week, so that this committee has no chance to spend a little bit of time taking a look at all aspects of the bill?

I think all of us want to cooperate. We recognize the problem. But this is ridiculous! It is absolutely absurd that this committee is being put into a box this way and not being given a chance to properly consider what could be the most fundamental scientific decision that this committee will make in this session of the Congress.

Personally, I find it appalling. I am just wondering why in the world this thing is on such a fast track.

Mr. **Perkins**. First let me state, Mr. Walker, that I do not think we are railroading the bill, by any means. We worked some days 8 and 10 hours to get this bill out of committee. It may be necessary for all the committees to work 10 to 12 hours.

The majority leader told me Tuesday—I did not offer any suggestions to the majority leader—that this bill would be the only business on the floor this next week. I told him that we could get ready, that we have had hearings off and on on this subject since 1958 in our committee. There has never been a year that somebody has not come forth with suggestions about science and math when we have extended the National Defense Education Act and all the student assistance programs. That issue has been raised throughout the years.

We thought, with our experience, that we enacted a sound bill, a good bill. Of course, it can be improved, no doubt. But I think we exercised a high degree of care in reporting the bill without shooting from the hip. That is my best judgment.

Mr. **Walker**. Well, Mr. Chairman, the problem we have here is the fact that we have 14 new members on this committee. Now, these are people that should have an opportunity to have some input to a bill of this importance. They have not had the experience of being around here for 20 years looking at this legislation, and yet they are being asked to consider something here in a very, very hasty procedure, and I think that this is something that certainly we could have taken a few weeks on rather than this kind of procedure.

I am perfectly willing to work 8- and 10-hour days, too, and I think this committee is. I have never found a lack of effort to be the problem of this committee. So I do not think that is the problem. I think the question here is that we have summary sheets here of the bill; we keep hearing that there are changes in mind for it; we are not sure that we have a handle on just exactly what it is you are bringing to the floor next week.

Mr. **Perkins**. Well, let me state again that I believe you can get a complete handle on it by next week.

Mr. **Walker**. By next week? What about today, when we are working on it?

Mr. **Perkins**. I mean week after next.

When I came to the Congress here, we had the minimum wage, we had the Taft-Hartley Act, and so many controversial items to consider, and I occasionally held night sessions if it were necessary. In 1949, we would run every night for weeks and weeks and weeks. If it takes it for your new members, if they want that type of hearing within the next 2 weeks, I am sure your chairman will accommodate any new member on this committee and give them all the time and let the new members call in witnesses. You have, I think, ample time in the next 2 weeks, Mr. Walker.

Mr. **Walker**. Well, I thank the chairman, and I understand that he wants to push this on and meet the majority leader's schedule. I guess it is the majority leader's schedule that I need to check with. But I thank the gentleman for the courtesy.

Mr. **Perkins**. That is correct.

The **Chairman**. Thank you very much, Mr. Perkins, and if we are still going hot and heavy when you get through, we may need you to come back.

Mr. **Perkins**. All right. If you want me, call me.

The **Chairman**. We are happy to have a new member of our committee and a long-time member of the Education and Labor Committee and one that has been in the forefront of education for many, many years and has a very outstanding reputation in the field of education, Paul Simon.

STATEMENT OF HON. PAUL SIMON, A MEMBER OF CONGRESS FROM THE STATE OF ILLINOIS

Mr. **Simon**. Thank you, Mr. Chairman.

The **Chairman**. Welcome to your committee now.

Mr. **Simon**. I am happy to be here testifying before my own committee. I am one of the 14 new members that Representative Walker is talking about.

I have a formal statement I would like to enter into the record.

The **Chairman**. Yes. We will make it part of the record at the conclusion of your oral presentation. If you want to summarize, that will be fine.

Mr. **Simon**. Then if I can just summarize and elaborate on a point or two that Mr. Gregg touched on, I would like to do so.

First, when we talk about the science and math problem, we are really talking about a problem that is more pervasive than math and science. If I can just discuss briefly the broader perspective, the committee will understand we have some major educational problems. We have not emphasized education in our country as some of our competitors are doing.

A couple of quick examples might help. In the United States, in the elementary and secondary schools, students attend an average of 180 days a year. In Japan, a student attends class 250 days a year. We go 5 days a week to school. In the Soviet Union, you go 6 days a week to school. I could give other examples.

Second, we have not placed, as a Nation, the kind of priority on education that some of our competitors place. At the current time, It is particularly severe in the science and math area. I am carrying coals to Newcastle here when I talk to the Science and Technology Committee. Just to mention as one other example, when you graduate from secondary school in the Soviet Union, you have 4 years of physics. Of those who graduate from high school in the United States, 16 percent have one year of physics. We have more school districts in the United States than we have physics teachers in the United States. My friend, Rep. McCurdy has been one who has been preaching this message.

Now, I am here testifying only on part B of title I. I am less knowledgeable, on part A, and I am not equipped to answer any questions on part A. On part B, we worked with, particularly, Congressman Bill Goodling and Congressman Tom Coleman, who see the ranking minority members on the Elementary and Secondary and Postsecondary Committee in preparing this.

Mr. GREGG. Would the gentleman yield?

Mr. SIMON. Pardon?

Mr. GREGG. Would the gentleman yield?

Mr. SIMON. I would be pleased to yield.

Mr. GREGG. Can you tell me, when you are referring to part B, we have in front of us this H.R. 1310, which has as its part B the section entitled Congressional Scholarships, involving 300 individuals in the first year, 600 individuals. Is that what you are referring to as your part B, or is there a new part B?

Mr. SIMON. There is a new part B. This happened yesterday, and it is not my decision how fast we move on anything. But there is a new part B. If I may, I would like to explain simply the congressional scholarship, and I am sorry I am not here with the language.

The CHAIRMAN. Paul, there is before the members what is called an amendment to H.R. 30 offered by Mr. Perkins, and the code is SACH30A.

Mr. GREGG. That is what we are working from, then, part B as submitted this morning with this amendment here?

The CHAIRMAN. Part B as is contained in that. Yes.

Mr. SIMON. I do not have the document that you have in front of you, and so I am not sure we are talking about the same part B in H.R. 1310.

But the reason that the particular congressional nominations were dropped was at the request of Bill Goodling, specifically, and Tom Coleman, who felt that this was not a desirable thing for a great variety of reasons. I did not feel strongly on it. I modified those provisions, and we have some new language

Basically, let me just outline what the new bill includes. One other area that you touched on, and that is the foreign language provisions. We included this in part B. It is not in part A, in the elementary and secondary, though there was some discussion about including it.

We have had testimony, as you may be aware, from the Defense Department and the CIA saying that they face major problems in this area of foreign languages. Admiral Inman, former Deputy Director of the CIA, who is probably as knowledgeable in this whole area of intelligence as anyone, has told my subcommittee that we are courting disaster by our neglect of the foreign language area.

While I recognize that the major expenditure is going to be in the area of science and math—and, incidentally, we had witnesses who testified from the science and math community that part of the problem is foreign languages and our inability to keep up on what is going on technically with other countries—we felt that foreign language was important enough that it ought to be included.

We basically provide 5,000 scholarships the first fiscal year and up to 10,000 the second year. These are scholarships that can be used at the undergraduate or graduate level from junior year in college up, and they are scholarships that can be added to the present Federal student aid programs. In other words, if you get a Pell grant or a guaranteed student loan, these can be added to it up to the cost of attendance. The cost of attendance at the school would be the maximum amount that you could receive from all of the programs.

Then for every 2 years you taught in school, you would have 1 year forgiven on the amount of the grant.

Nominations are made through the chief State school officer or the chief higher education officer, and you have a Federal committee working with the Librarian of Congress, the Director of the NSF and the Secretary of Education plus of 10 other people that would make the final determination.

Mr. MCCURDY. Would the gentleman yield on that point?

Mr. SIMON. Yes, I would be pleased to yield.

Mr. MCCURDY. I am trying to follow the different portions of the bill. The only number on the page is 4, and I think it is in that same part B that you are talking about. It is talking about the scholarships. It says:

> Individuals shall be selected on the basis of merit and shall be pursuing a course of instruction in science, mathematics, foreign language, or other course of study identified by the chief State school officer of the pertinent State as having a critical shortage of qualified teachers.

Would you care to explain that? And isn't that something that is totally opening up the door? If my State superintendent says, Gosh, we've got problems with home economics teachers; we don't have enough home economics teachers in our schools; or we don't have enough gym teachers or drivers education teachers, and we don't have anybody applying for this scholarship, and I've got a good person out there that is going to come to Oklahoma and teach this course; can I redirect that scholarship program to them? My concern is the targeting—and I am not going to argue with you on the language, because when we were in Japan, in meeting with some students, we heard testimony that one of the biggest problems, quite frankly, in any transfer program is that they have engineers studying in the United States because they can speak English; we don't have engineers studying in Japan because they don't speak Japanese.

Mr. SIMON. That is exactly right.

Mr. MCCURDY. The point is taken and well taken. I will not differ on that.

Isn't this a little loose? When my time comes, I will again talk about the track that we are on. But isn't that the kind of problem that we are going to be experiencing in this bill?

Mr. SIMON. Well, it is possible. We hope that through report language and in other ways we can make clear that we do not want to just open this up to drivers education and other things.

It was felt by the members of the committee that there may be some other critical shortages that come up. I do not know what they might be, and I cannot anticipate them, but if there would be critical shortages within the State of Oklahoma, then that chief State school officer would have that liberty.

Now, you have, however, an added safeguard, and that is, you have this national selection committee that approves these, so that you cannot just have an arbitrary decision by a State school officer in Oklahoma or Illinois or someplace: "I have a friend who wants to be a history teacher, so I'm going to declare that a critical need." It has to be something of some national signifiance. Otherwise, the national committee simply is not going to approve it.

So you have that safeguard. I am not opposed to—we have nothing written in concrete as far as language, but we felt that there ought to be some flexibility because we do not know what is going to appear 3 years down the pike.

Up to 30 percent may be reserved by the Secretary of Education—this is in line with the administration's bill—for awards to people who are currently teaching, scholarship awards of up to $5,000 a year. So if someone who is currently teaching science and math needs to be upgraded, that can be done, or if someone is teaching English and wants to shift over, you can do that. That is the reasoning behind that provision.

There is a provision for upgrading faculty and for curriculum improvement in these areas in the colleges and universities. The problem is not simply in elementary and secondary schools. We also clearly have a problem at some of our colleges and universities.

Summer institutes are stressed. Summer institutes based on our experience under the National Defense Education Act, were extremely helpful, and they are a fast way of really improving the capacity of those teachers in the classroom. I think it was unanimous that we reserve up to 35 percent of the funds for the summer institutes. It is a way of really moving rapidly to enhance quality. What we are really talking about is the quality problem.

We reserve up to $5 million for the National Institute of Education to direct research on where we go.

Then, finally, the minority institutions science improvement program, which is already the law, we simply extend through fiscal year 1984 in the act.

That is basically what we do in part B. Again, on part A, which is Chairman Perkins' territory, I am not that familiar, but I would be happy to answer any questions.

Let me add again for the benefit of my Republican colleagues, we worked with Tom Coleman and Bill Goodling in crafting the end product on part B, and I have to say in fairness the same is true on part A. It is not a partisan product.

The CHAIRMAN. Mr. Durbin?

Mr. DURBIN. Thank you, Mr. Chairman.

Congressman Simon, as you well know, I am a faithful disciple of your project here, and I believe you are on the right track with foreign language, and it should be included in this effort.

I have a question, though, Paul, and it is this: I see in this effort improving the quality of people who teach foreign languages. What I think is lacking in the process today is an incentive for a student in elementary or secondary school, and particularly in college, to take a foreign language. As long as there is no incentive, I am wondering if we are not preparing a class of people to teach a subject when in fact there will be a party and no one will be attending.

Now, when I went to school, it went without saying in high school that if you expected to attend college, you were expected to take a foreign language in high school; and if you expected to get a bachelor of science or a bachelor of arts in college, you could readily anticipate at least 2 years of a foreign language in college.

I think those things have changed remarkably. As I talk to my local school districts, I find there are foreign language teachers. Students are not taking the courses, and when the classrooms are empty, we could have the best teachers in the world.

Do you address that aspect, or how should we?

Mr. SIMON. We do not address that aspect here. It is a very real problem. Those requirement you spoke of would have to be imposed by local school boards. What we do address is, we have opened the possibility of addressing areas where we do have some very severe problems, and without getting into classified information—and it would be of interest to this committee, incidentally, to have an executive session with the CIA on some of the problems they are facing in this area.

Let me just mention a couple of areas. The CIA has great difficulty in getting people who have language skills in certain areas, and there are some areas where you just cannot find universities that teach the kinds of languages that are needed. This is one of the problems.

Let me give you another example. This figure now is about a year old, and someone can update it. But as of a year ago, we had 488,000 armed service personnel stationed overseas in the U.S. Army. Of that number, 512 were regarded by the Armed Forces as linguistically competent in the language of the nation where they were stationed.

Now, if you have the North Koreans moving into South Korea, somehow, if we are going to have adequate security, we have got to be able to communicate with the other South Koreans, with the South Korean military, and so forth.

So we have a problem. We do not address your specific concern. Tom Coleman and I are cosponsoring a bill that later on will come down the pike that I think will address that concern. But we do have, frankly, not so much in the traditional languages—French, German, Spanish—problems of shortages of teachers. We do have in Japanese, Chinese, some of the other languages, we do have some very real problems.

The CHAIRMAN. Mr. MacKay?

Mr. MACKAY. Congressman Simon, I would like to ask a couple of questions about the part B to which you testified.

It seems to me that if you want to talk about an emergency bill, then we should identify that part of the problem which is emergency, and that part of the problem which is emergency is the lack of qualified science and math teachers in our school; 15 to 20 percent of them are leaving per year, and the reason they are leaving is that the salary differential between their salaries and those of competing fields is broadening rapidly, primarily because of the demand for mathematicians in computer sciences and others. They have opportunities now they did not have before.

At the State and local level, people are trying to deal with that by offering salary incentives and tying that to in-service education. I think I heard you say that 30 percent of this money could be used for in-service education. I wonder why a limitation of that type if this bill is an emergency bill. It would seem to me the way to deal with it would be to acknowledge that what you need to do is make teaching of science and math a more attractive thing and try to hold and upgrade the teacher cadre that we have on hand now.

Mr. SIMON. The answer is, we are hoping through this bill to tackle both the emergency problem and the long-range problem somewhat.

Let me just add, you touched on a very key issue, and that is, we can have all the programs in the world, but if we do not increase salaries at the local level, if we do not increase the pay for math and science teachers, we are spinning our wheels. There is just no question about that.

So that is a fundamental problem that, obviously, Congress cannot address. But what we do, the 30 percent is for scholarships for teachers who are already teaching. The balance is for those who are still studying in school, where we are getting very, very few.

The State of New York, for example, last year I believe, graduated a grand total of around 36 people who were preparing to be math and science teachers. Well, we just cannot tolerate that.

And so what we are doing, we are hoping through this scholarship program to hold out a carrot to get people to say, I want to study to be a math or science teacher. Even if they end up teaching—let's just say they get a 2-year scholarship, and that means they have to teach for 4 years. If they teach for 6 years and then go to work for Dow Chemical, we still have 6 years of service out of them, and from their point of view, they have secured substantial assistance to get through college.

So it is an attempt to attack both the long-range and the short-range problem. I think it would be a mistake simply to overload with training existing teachers. I think we have to be looking at those who are training to be teachers, also.

Mr. MACKAY. I agree with that, but it seems to me that it is a mistake for us to set the priorities instead of allowing those who are delivering the services at the State level to make that decision themselves.

Mr. SIMON. Well, I think, to some extent, as we structure the financing, we have to make those determinations. In the case of the 30-percent provision for current teachers, it was frankly an arbitrary figure that Tom Coleman and I agreed on. It could have been 25 percent or 35 percent.

Mr. SENSENBRENNER. Mr. Chairman?

The CHAIRMAN. Mr. Sensenbrenner?

Mr. SENSENBRENNER. Thank you, Mr. Chairman.

I sat in on several hearings on this subject last year. The testimony repeated time and time again that the big problem we have is retention of qualified math and science teachers. Upgrading capabilities and attracting new teachers into this discipline is important, but the other problem is bigger than the two I just mentioned.

Now, how does this bill address the problem that the teacher union contracts, that most school districts sign provide for uniform salary with a given amount of seniority? The science teacher with 15 years of seniority gets paid the same amount as the gym teacher with 15 years of seniority. The science teacher then jumps into the private sector at a substantial increase in salary, and we lose that person teaching children for the rest of the person's productive years.

It seems to me that this bill completely ignores this, both in part A and part B. Could you please respond to that?

Mr. **Simon**. Yes, I would be pleased to.

You are correct; the bill does completely ignore that. It becomes very, very difficult for the Federal Government to intrude into the local labor-management negotiation process. It relates, frankly, not only to science and math teachers. It relates to both attracting and keeping quality teachers, period.

If I can revert to the overall picture again, one of the things that is happening is the quality of those who are going into teaching in this country is declining very, very rapidly in terms of those who are attracted. The verbal scores in the last 8 years, for example, on SAT's have declined 79 points—the math drop has not been quite as precipitous—among those who are planning on going into teaching.

On top of that, we have had a study in North Carolina and in Wisconsin which suggests not simply in math in science but across the board we are losing many of the very best, most capable teachers. One of the reasons is touched on by our colleague, Bud MacKay, and that is base-level or entry-level pay.

But another reason is one that you touched on. I think it is one that the teachers' unions and the school boards and school administrators have to face up to, and that is, if you are the very worst teacher in the school, you get the same pay as the very best teacher in the school, and that discourages the best teacher from staying.

Now, at the college level, we have solved this.

Mr. **Sensenbrenner**. If I could interrupt you on that. At least in my State, which was one of the guinea pig States, the teachers' unions, in their bargaining position, have adamantly opposed merit pay systems. They want to have this uniform pay system, and it seems to me that my good friends in the Education and Labor Committee, who have far more expertise in labor questions than I do, ought to really be addressing this. You might be stepping on tails you don't want to step on, but I think this remains one of the major problems in education today.

Mr. **Simon**. It is a major problem. The Congress has no constitutional basis to intrude in this case. I would simply say it is a problem, as a matter of fact, it is a problem that I tried to address with a resolution in the last Congress. I did not get very much support on your side of the aisle, a resolution we brought up under suspension asking each State to set up a commission to look at the whole question of teacher excellence. I think that is one of the points that has to be addressed.

At the college level, we have solved the problem, so to speak, by creating various categories—professor, assistant professor, and so forth. I think, at the elementary and secondary level, eventually we have to have some kind of a gradation system, not simply at the arbitrariness of an administrator, but to some extent collegial in judgment, as it is at the college level.

But I think there are areas where the Federal Government traditionally has not gotten involved, and teachers pay is one, and I think we ought to insist entering this area. While today the Federal Government might do something you and I would like in this area, tomorrow, if we start intruding, we may be doing something that we do not like.

Mr. **Sensenbrenner**. Would you support legislation that would provide a Federal merit salary supplement for outstanding teachers in the math and science area to keep them teaching in the schools, rather than going into the private sector?

Mr. **Simon**. I do not know that I would support it simply for science and math alone, but I think that area of a broader bill I would be willing to look at. But again, we are talking about the Federal Government going much beyond where we have ever gone before.

The **Chairman**. Let me make an announcement to the committee. First of all, we will be having another hearing on Wednesday of next week to hear outside witnesses. It is our intention on February 22 to mark up the bill and report the bill.

Now, the other part is that Mr. Simon may not know it, but his staff has arranged for somebody to preside over your hearing, so you can stay.

Mr. **Simon**. OK. [Laughter.]

The **Chairman**. The trusty staff has kept up with the Members as they came to the meeting, and we will proceed in that order at this time. Some may get called again, but that is their good fortune. I had just been bouncing around as people raised their hands, but we will proceed down an order.

At this time I will recognize Mr. McCurdy.

Mr. **McCurdy**. Thank you, Mr. Chairman. Again, thank you, Mr. Simon, for your efforts in this area.

The **Chairman**. We will operate under the 5-minute rule.

Mr. **McCurdy**. Right. Thank you, Mr. Chairman. Please start now. [Laughter.]

I do not dispute the statement by the distinguished chairman of the Postsecondary Subcommittee of the Education and Labor Committee. He allowed myself and Senator Glenn to testify last year on this issue on the bills that we had introduced and reintroduced this year.

I cannot dispute the fact that he was talking about this issue in Congress in 1949. I was not born in 1949, so I do not have the longevity nor the expertise that he does. However, I do bring some background into this area and have discussed this issue and have worked with a number of distinguished people who have been around longer than I have.

I feel like that person who has been out on the train track with my knapsack waving on this issue, and all of a sudden the train is coming, and if I don't hitch a ride, I am going to be run over.

I think that the time frame is very important here. I have some serious reservations about the language, not the intent. My gosh, I don't care who gets credit for it; let's just get it done. But let's do it the right way. Let's insure that we are addressing the real issues and the real problems.

If language needs to come on this, that is great. I will jump on board that. I think that is superb. But we do have some basic problems that I am not sure we have addressed. First of all, I think Mr.

Sensenbrenner and many people on the minority side have adequately raised the question of upgrading the personnel the retention factor. I have a separate bill on tax credits for high-tech firms to employ teachers that would help solve the pay differential question. That is a very important question, one that a number of people on both sides of the aisle are coauthors of and are supporting.

We need to have some language maybe suggesting to the Ways and Means Committee—or again we need to have an effort here. We have bipartisan support on this issue, so again, I think I am trying today to just say, Let's slow the train down just a second to fully appraise this situation.

I have already 14 associations, national associations, that support our bills, that have worked closely with us: The National Association of Secondary School Principals, the National Council of Teachers of Math, the National Science Teachers Association, and the list goes on. We have worked with these people, we have worked with industry, to get their testimony and their support.

Now, I understand one of the problems you had was loan forgiveness, but isn't your scholarship program a much looser program than a loan forgiveness program, when you have the requirement that if they do not stay in the field, if they do not stay and teach, then they are forced to pay the loan back? I understand you have some provision—I have not found it yet—that says that the scholarships might have to be paid back. Well, that is a loan forgiveness, isn't it? And shouldn't we look at the possibility of having a tighter plan?

Again, I mention the tax credits for the high-tech firms. I have a third bill that we have been working on for some time on retraining and in-service training. Again, I think there has been such a jurisdictional paranoia going on. I apologize to anyone in this area if I am stepping out of line, but there are jurisdictional fights in this body, and I understand that, and I think, in the effort to overcome this jurisdictional nightmare that we appear to be having, that the people in this country and the issues that we are trying to solve are getting railroaded and sent down the wrong track, because we are not addressing the critical issues. We are loading this thing up to such an extent that we are going to come out with a bill that has nothing of the original intent. We are just throwing it together.

It is kind of like the tax bill of 1981. Remember those things? Now everybody is saying, My gosh, wasn't that the worst thing that ever happened?, because you started the bidding process, and it started getting loaded up.

Well, my statement is here—and maybe it is a statement for the record—we are bidding, we are playing jurisdictional games. I am a second-term Member, so maybe I should not speak up on this issue, but, by gosh, to the American public and to the people who have been working on this issue for a long, long time, I think we have to address it.

I am not going to stand up here and wave furiously in front of the train. I am going to jump on the train. But let's please work on both sides to see if we can slow it down just a little bit, to see if we can improve the bill, because, who knows, 30 years from now, maybe I can sit on that side of the table and say, In 1982, I was working on this issue, and maybe I can have that authority, but, hopefully, I will not be referring to the National Education or Emergency Act, or whatever the title is, and say, You know, but if we had only taken a couple more days that year, maybe we would have this problem licked today. Maybe we would not have the cyclical problems of shortages, the cyclical problems of demand. Maybe we could address those things.

My bell has rung. I didn't even get a question in. I apologize, Mr. Chairman.

The CHAIRMAN. You made a good statement, Dave.

Mr. McCURDY. I sense a frustration here, and I think you sense my frustration. And again, Mr. Simon, you know that this is not directed at you. I am just maybe venting here a little bit because I feel that this is the supertrain that we rode on in Japan, and they have better technology than we do. We cannot even get trains up to 50 miles an hour in Oklahoma any more because of the tracks.

We have problems here. I would hope that we would take just a little bit more time to work out these problems.

By the way—one last statement—I am on the Armed Services Committee, I am on this committee, and I am also on the Intelligence Committee, and so each of those points you raise about the CIA and languages and defense and industry and education are areas of concern, and I think we have to address it.

Thank you.

Mr. SIMON. If I could just respond briefly, Mr. Chairman, first of all, I want to commend my colleague for his leadership. There is no question that you have done more work in this area recently than probably any other Member of the House, and perhaps any Member of the Senate. I am not qualified to judge on that side.

On the turf area, I am not one who gets in all kinds of turf fights. I have always found I had plenty of work to do without trying to do that, and at some point there was, I think, largely maybe between the staffs, some unhappiness. I suggested to the chairman of my Education and Labor Committee that he ought to get together with Chairman Fuqua. He said, Well, you are on both committees; you come along. The next thing I knew, I was there, too.

But I think we have to be working together, not only between committees but between the two parties. We are not talking about a partisan thing here. This is something that we ought to be able to agree on.

We did talk about the tax break thing. That was discussed at some length. We finally decided that the last thing we needed was a bill that is going to have to go to the Ways and Means Committee, too. And so that was dropped for that very practical reason. But there is no question that our committee would just overwhelmingly support such a provision.

On the forgiveness on the loan thing, we modified that, in part because CRS told us that the loan forgiveness, the experience is that it just does not work as well as a grant, with strong service and penalty provisions. And so we modified this. Instead of, as the bill originally was drafted, you have to teach 5 years and then you get a forgiveness, we require that you teach 2 years and you get 1 year forgiveness on your scholarship. The feeling is that this is worth an experiment, that it might work, and that it might help.

Mr. McCurdy. Excuse me. How do you give a forgiveness on a scholarship?

Mr. Simon. Well, I have to tell you, I don't know exactly how that works. How do we structure that?

Mr. McCurdy. I mean, it is a scholarship, is it not? A scholarship is a scholarship; it is not a loan. A scholarship is a giveaway. You either earn it by merit or by need, whereas a loan is something that there is a contract. There is not a contract in a scholarship.

Mr. Simon. Can I refer to my staff director here?

Mr. McCurdy. Yes; your distinguished staff man is a good person. I have worked with Buddy a number of times, and maybe he can tell me.

Mr. Blakey. The provision in the law says simply that for every 2 years that you teach, you don't have to repay it. If, in fact, you fail to fulfill the service commitment, then you would have to repay the scholarship, even though it is given to you.

In the area of service obligations, there are a number of other Federal programs which we have, one of which is in the health area. As the chairman indicated a few seconds ago, CRS has done a study on NDSL, national direct student loan forgiveness, and on grant programs. The track record says that labor shortages are not removed with loan forgiveness; they are more expensive than a grant program. Two essential things must be there. One, if you have an extensive service commitment and a penalty for failure to complete the service commitment on a grant program, that works better than a loan forgiveness program.

So, in a sense, we have patterned this after the health service scholarship program in which you have a requirement—you get a grant, it is a grant, and you teach or you go into medical school and serve in an underserved area. If you fail to complete the commitment in the underserved area, then you are obligated to repay, and there is a penalty provision.

What the CRS study says is, with that kind of provision, that that works better than a loan forgiveness program.

Mr. McCurdy. Mr. Chairman, I ask unanimous consent to proceed for 1 additional minute for one question.

The Chairman. Is there objection?

[No response.]

Mr. McCurdy. Thank you, Mr. Chairman.

I have read that CRS report by Forbas Jordan on the experience of the National Defense Education Act. I know what you are talking about. I differ totally because it is two different programs. We are talking apples and oranges. Mine is much tighter, and I think loan forgiveness is tighter.

When you talk about scholarships, grants—and, again, it may be the language. Maybe we ought to just say it is a loan. I do not know, but I am just raising the point, and the bottom line again is, we are rushing into this. That sounds like a fee simple with condition subsequent or some crazy thing out of ancient English law or something. I don't know how that works. Maybe we should have the national association or one of these teacher groups come in and say, What is your experience?; How do you think this is best handled?

There are just so many questions that I have. Again, it is the frustration that I have not had a chance to have them adequately addressed.

Mr. SIMON. If I could just add, the way we had the bill originally drafted was that you had to teach 5 years, and it was these teacher groups that came in and testified that said, We don't think that is going to work. And so we modified it to the 2 years of teaching for 1 year of forgiveness. That was their testimony. They felt this would work more effectively. We felt, let's try it.

The CHAIRMAN. Mr. Gregg?

Mr. GREGG. Thank you, Mr. Chairman.

I would like to say "Amen" to everything that Congressman McCurdy said. He said it with the intensity and feeling which comes from a person who has been intimately involved with this issue, as I have been, at a higher level than I have been, however, as one of the leaders, if not the leader, in the Congress on the issue. He is absolutely correct; this is being railroaded through. It is an excellent metaphor to use to express the actions that we are being confronted with here.

Quite honestly, Congressman Simon, I have respected you for many years, but I do feel that you sort of insult our intelligence when you come here and tell us that this is not a partisan issue, that you are not addressing this in a partisan way.

We offered, as a minority, to participate in this process. I was not invited to testify before this committee which held these hearings on your bill, nor, from my understanding, was anybody else on the minority side on Science offered that opportunity.

We were not given the opportunity to review these documents. This is the first time we have seen them. Had it not been for the intervention of the ranking member on this side, we would have had a markup today on this. That is how fast this was coming at us. We would not have even seen the bill. It would have simply been marked up today without our even seeing it, and it was simply through the intervention of our ranking member and his good offices with our chairman, who is a very fair individual and understands the circumstances, which I suspect are beyond his control, that we were able to put this off for a week.

The powers that are moving this bill are not on this committee. This bill is being moved in a partisan purpose by powers beyond this committee. And I think it is totally unfortunate because, as Congressman McCurdy has said, this issue is one of the most essential that this committee is going to have to confront in this Congress and which this Congress should confront as a whole.

The minority members are totally committed to the issue. I personally have no problem with the dollar figures, and in fact I think your proposal is a fundamentally sound one. I happen to subscribe to Congressman McCurdy's approach on how the loan program should be set up. I also feel that we should delete the language which says that other courses of study shall be identified, because I think that opens the bill up too much. As to the foreign language issue, I think that that is a reasonable issue to have in there. Even though it is not math-science, I recognize the utility of it.

But, we are not going to have time to address those. We are not going to have time to substantively hear before this committee the issues which Congressman McCurdy has addressed. What we are going to have time to do is call on a few witnesses next Wednesday whom we can gather up, hopefully, who will be able to get a final copy of the bill; have them review it over the weekend and then have them address it in a radical manner that will not be substantive.

It is really unfortunate the way this is being pressed, and I think it is going to reflect on us as a committee, on the professionalism of this committee, which has always been very high, and on the inherent bipartisan approach which we have always attempted to take in this committee. I just regret it.

As to your proposal on part B, I would simply, with those reservations—and also, I think it ought to have some sort of sunset provision—put them down for the record.

Thank you.

Mr. SIMON. Let me respond very briefly.

On the time track, I have not set that; that has been set by others.

On the partisan matter, let me say, in fairness to my new chairman here, Don Fuqua, that I, in my years in Congress, have dealt with every chairman in this Congress, and I do not think there is any who is willing to work more with people on both sides than is the chairman of our Science and Technology Committee.

Mr. GREGG. Well, if the gentleman will yield there, I believe I structured my comments in a manner which did not reflect on the chairman of this committee, because I do not consider it to be the chairman who is pushing this.

Mr. SIMON. All right. And let me add, as far as part B, and that is really all I am that knowledgeable about, we worked closely with Republicans on our subcommittee. Any witness that they wanted to call was called. The product that we have, while you may differ on some of the language—and, for example, maybe we should tighten this one on whatever the State school superintendent designates—but the language, whatever its defects, is not partisanly drawn. Finally, Chairman Perkins did send a "Dear Colleague" to all Members inviting their testimony on the bill.

Mr. GREGG. I yield back.

The CHAIRMAN. Mr. MacKay?

Mr. MACKAY. I will try to be brief.

It is ironic that this would be the first actual bill that I would be participating in as a new Member of Congress. The States have been dealing and trying to work on this problem for a number of years. I have worked with the Southern Regional Education Board and the Southern Governors Association and have chaired hearings where we got the teacher unions from the 14 Southern States together and said, "How can we go about having supplements for salaries for science and math teachers?" As Mr. Sensenbrenner said, "There is no way you are going to deal with this problem unless you can raise the salaries."

They have identified three ways we could do this that would be least objectionable. They never said that there would be an unobjectionable way, but they said there are three ways you could do it, one of which would be to offer 12-month contracts with stipends for in-service education during the summer months, in effect giving a supplement.

Another way is master teacher designations. And a third way is an emergency supplement for math and science teachers.

Now, the only thing I am worried about in this bill, frankly, is that we do not put it in such a way that it cannot deal with what the true emergency is. I am afraid that the language—and, unfortunately, it is in part A—has sufficient restrictions so that a State getting this money—and it is not going to be enough money to make a major impact, anyway. In Florida's case, it is $7.9 million, and $7.9 million is not going to do much, and it is not going to do anything at all if it cannot help the people in Florida deal with the question of salary supplements.

What I would like to know is, in the complexity of the way we are trying to deal with it, is there not some way we could amend it so that the States could use this money, in effect, as seed money to move in the direction they are trying to move in dealing with this problem?

Mr. SIMON. Let me tell you one other very practical consideration. In addition to being totally new turf for us if we get into the salary supplement thing, we are talking about huge increments in dollars. We are in a situation where the administration requested $50 million, where the Senate has a bill for $250 million, and we have a bill for $300 million. Now, if we add salary supplements——

Mr. MACKAY. I am not asking that we add it. I am just asking that we put language in there saying that nothing in this bill shall prevent the use of this money for such things as salary supplements in connection with in-service education or master teacher designation or a determination that there is a necessity for an emergency salary supplement to retain math and science teachers.

Mr. SIMON. No. 1, there is nothing to prevent that right now. I guess I would not object to inserting that language, unless we ended up getting some massive labor-management problems with school superintendents and some of the teachers organizations. I would be concerned about that.

What we do provide, the summer institutes do—there can be a stipend, and that will help on the salary question. To that extent, there is a pay supplement. But again, when you talk about $7.9 million in Florida, and if you are talking about using that money to add to the math and science teachers, by the time you spread that around the State of Florida, you do not have very much money for any science and math teachers.

Mr. MACKAY. I fully agree with that, and that is why I wonder about all the haste of the bill. It is marginally relevant at best.

Mr. SIMON. Well, I guess my feeling is, what we have through scholarships, through summer institutes, particularly, I think, can improve the quality of the teaching and attract more quality teachers into the field. But it does not address every problem we have, and it does not address the most fundamental problem, and that is pay.

Mr. MACKAY. Thank you.

Mr. SIMON. Thank you.

The CHAIRMAN. Mr. McCandless?

Mr. McCandless. Yes; Mr. Simon, I, too, am a new kid on the block from California, but I am not new to the problem that you have presented us with this morning, having spent 12 years in local government and seeing more the failure of education than the success of it, by the size of our county hotels and those who inhabit them on a monthly basis.

I have a concern here that we do not seem to address, and that is that these teachers that we are talking about, irrespective of the numbers, start out as students. Successful students are people who have acquired certain skills, basic skills, in the learning process.

One of the problems in the California institutions is the level of the finished product at the secondary education stage in moving into higher education and their inability to function in that arena, which in a sense would appear to me, if my scenario has some validity, that we need to address that area of basic skills in order to have a better product entering into the educational field for purposes of making a career out of it. And in so doing, the numbers, it would appear to me, would increase because the motivation of wanting to go further would be there due to the fact that they had mastered their basic skills.

This is kind of an old-hat, rehash type of thing, I realize, but this appears to me, with all due respect to the intent, to be some kind of a band-aid approach without the necessary solid foundation upon which to build. I do not know if you wish to comment on this or not.

Mr. Simon. I would be very pleased to comment.

It is, in a sense, let's say a bandage rather than a cure, but when there is a wound, sometimes a bandage is better than nothing.

We do not pretend that this solves the basic problem, and you are correct. It is very interesting that the dean of the graduate school of the University of Oregon did a report for the Office of Technology Assessment [OTA] that says, we can address this problem a little, but if we are really going to look at the math-science field, we have to address the total education picture, and that is what you are talking about.

We have some major problems. Let me just give you two statistics that are really frightening, given to us by the Secretary of Education a couple of months ago. Of the 17-year-old blacks in this country, 47 percent are functionally illiterate; of the Hispanics, 56 percent. That says something about the kind of educational offerings in California and Illinois and elsewhere.

If we want to develop people with the right kinds of skills, we have to be looking at the total education picture. But in the meantime, we have an immediate and very pressing problem in this field of science and mathematics and foreign language that we cannot simply ignore and wait until that day when we gradually upgrade the quality of our public schools.

It is the sense of our committee and it is the sense, I think, of this committee that that ought to be addressed. A bandage right now is not the same thing as more fundamental surgery, and we are not suggesting it is a substitute for that, but it can help in a very immediate problem that we face in this Nation.

Mr. McCandless. Another statistic, if I may, Mr. Chairman, that is astounding to me was brought out in some kind of a discussion the other night. That is that 40 percent of the graduate engineering students now in the United States are foreign-born, which is an indication possibly that from development of teaching sources we do not have a solid base upon which to go forward in developing these teachers. However, we support them or subsidize them or try to educate them. The motivation for our own home-born, home-grown, evidently is not there. I do not know how this would fit in. Maybe you would want to comment on that.

Mr. SIMON. Well, it is a problem, and I think it relates to all the other problems. Japan last year graduated more engineers than we did. Japan has half our population. When you subtract those who are foreign students among our population, the figures become even more dramatic.

Japan, the year before last, graduated twice as many electrical engineers as we did. Who is going to be ahead 10 years from now in the electronics field? Well, you don't need to be a prophet to figure that one out.

So we have to address the problem, and this bill is an attempt, however modest, to at least say, Let's take a look a little more at this problem.

Mr. McCANDLESS. Thank you, Mr. Simon. Thank you, Mr. Chairman.

Mr. SIMON. Thank you.

The CHAIRMAN. Thank you, Mr. McCandless. Mr. Valentine?

Mr. VALENTINE. Thank you, Mr. Chairman.

Mr. Simon, my State, North Carolina, needs this kind of help as much as any other State in the union, perhaps more than most.

I am, of course, a new Member. I was around in 1949, but I was not in the Congress. It is going to be very difficult for me to vote against this sort of thing, to vote against this legislation, but I desperately want, especially for the first really important vote I cast in the Congress, to understand what it is that we are asked to do. I do not want to just have a problem identified and have the Federal Government throw a bale of money at it.

Without asking the impertinent question, what do you think the chances are of having the powers that be slow down on this process and give us an opportunity to understand more fully what we are asked to do?

Mr. SIMON. Well, I think that question probably ought to be addressed to the chairman of your committee and to the chairman of my committee.

As you will learn when you are in this business, when you are the chairman of a subcommittee or a member of a committee, you take your marching orders and you do the best with what you have.

I have no personal opposition to slowing this thing down a little. I think, clearly, we ought to be on solid ground, whatever we do.

Let me, if I may, digress for just a moment because you are from North Carolina. North Carolina is one of the few States that really has provided some leadership in this area. You have a State superintendent named Craig Phillips there who has put together, both in the area of foreign language and in the area of math and science, a program that is way ahead of most States, and you have a special high school for math and science where they attract students, the only State in the Nation where you attract students from all over that State, and that school last year had more merit scholars than any other school in the United States.

North Carolina, because of the emphasis on foreign investments by your government and the foreign language emphasis by your State superintendent, has more foreign investment than any other State in the Nation today.

So while I am sure you see many areas where North Carolina still has to move ahead, let me just tell you, you are ahead of Illinois and you are ahead of all the other States around here that I see represented.

Mr. VALENTINE. Well, I appreciate that. That sounds good to me. Craig Phillips is a good friend of mine, and I shall call him as soon as I leave here——

Mr. SIMON. You tell him he was praised here today, all right?

Mr. VALENTINE. And tell him what you said about him. But I think that is all the more reason that I would like to be able to explain intelligently to Craig Phillips what we did. [Laughter.]

One more thing and I will be finished. This is probably not within the range of what you are here to talk about, but let me just kind of vent with you another freshman frustration.

As I look at the summary that was placed before me this morning, it has title I on page 1, section 602, authorization of appropriations. There are so many needs in this country. Everybody's needs are the greatest and most important. That section, that summary, says $250 million for fiscal year 1984. On the next line, "Such sums as necessary for fiscal year 1985." What in the world does that mean?

Mr. SIMON. Well, that is a——

Mr. VALENTINE. If we were to sit here and say, well, now, we have just so much money to go around, and what do we have to spend, what is it supposed to mean to me as a new Congressman when the language says, for fiscal year 1985, "Such sums as necessary"?

Mr. SIMON. That means that for part A in fiscal year 1985, we are leaving it to the Appropriations Committee to determine the level of expenditure. It is a phrase that is used frequently in legislation in the House. You will get accustomed to the use of that phrase.

Mr. VALENTINE. And, at the same time, accustomed to deficits.

Mr. SIMON. Unfortunately, I fear you are right. I hope you are wrong.

Mr. VALENTINE. Thank you, sir. I hope so, too.

Mr. SIMON. Thank you.

The CHAIRMAN. I might point out that North Carolina has a very successful high school for science students, very bright students, science and math, and it has worked very successfully.

Mr. SIMON. And, incidentally, that is the kind of use—for example, Florida's $7.9 million may not go very far if you just spread it out a few dollars every school, but doing what North Carolina has done really does something, and it does something not only to those students that go to that high school; it says to the other students, you know, if you really try and you excel, you have some incentive, that you are going to get some special attention. I think that is worth doing.

The CHAIRMAN. Thank you.

Mr. Chandler.

Mr. CHANDLER. Yes. Thank you very much, Mr. Chairman. I can see from the remarks of Mr. McCurdy and my colleague from Florida that we have some similar experience and background, and I want to offer to them my assistance in achieving their goals and perhaps working together on some things that I am interested in.

I do have a concern that I just want to state briefly. That is, I think that sometimes as a society we tend to react to problems, and we are very much pendulum-swing kinds of reactionaries. I think that the fundamental problem with education in the United States is that teaching does not enjoy anywhere near the status nor the pay that it deserves; that in 4, 5, 2, 10 years it will be the social studies, the arts people who are here, saying that we have been overlooked and our people are ignorant of those things. I think we have completely overlooked—and in fact it borders on criminal—what we are doing to the gifted and talented students in this country.

This is no criticism of you. I tend to trust people who wear bow-ties. [Laughter.]

But I think that it is something that we certainly need to be aware of.

I also want to state, as my colleague from Florida points out, that with $7.5 million to address curriculum improvement in the higher education institutions in the country, I am concerned that we are not spending enough and that we may in fact simply be wasting the amount of money because it is not enough.

But the point that I would like to make, and ask your experienced opinion on, is this. One of the things that we have done in the State of Washington, with some considerable success, is to expand the work-study program beyond just work in the public sector, most often at the higher education institutions themselves and into private industry; a very successful, although admittedly small, cooperative effort.

Since I have joined the Congress a month ago, I have had the opportunity to speak with a number of people in industry, especially those in high technology, and ask them, would they be interested in a cooperative effort on work-study to expand what would be, in this bill, the $20 million effect for teaching scholarships for those heading into the teaching profession. The obvious benefit is, from the start, you take $20 million and perhaps, at a minimum, double its effect. You also give a teacher or a person who will become a teacher the benefit of the experience of working in the very industry that they will one day be preparing students to enter.

Probably even more basic than that, you provide a student an opportunity to earn his way through school and, therefore, will not have a loan to pay back. Additionally, for the benefit of the taxpayers, he will do it without having received a grant.

Every study that I have ever seen shows that workstudy students invariably do better in school than do—and your staff man, Mr. Blakey, is shaking his head yes, absolutely—they always do better in school than do those whose way is paid.

My staff and I are working as best we can. I would like to enlist the support of all of you, and especially you, Mr. Simon, to see if there is not a way that we could include, within this legislation, and I guess it is within the purview of this committee—God help us if we have to lock horns with the gentleman who was entering Congress when I entered the first grade—but if we can work on part B, perhaps we could do something, and I would like to enlist your support.

Mr. **SIMON**. Yes. Let me, first of all, indicate part B that we are dealing with is $50 million. Part A is $250 million. So we have to be careful that we do not spread ourselves too thin. We have limited resources.

Mr. **CHANDLER**. Yes, sir, I understand that.

Mr. **SIMON**. Now, what you say about work-study and cooperative education is absolutely correct. In fact, in addition to the college work-study program, there is a special provision in the law for this cooperative education. Northeastern University in Massachusetts is the main school in the country that has been taking advantage of it, but a number of schools around the country have, and it is an excellent program.

What we do call for, very specifically, in this bill is that these scholarships that are available can be available to somebody who is working for Monsanto Chemical, who would like to maybe try teaching. So you can take somebody who is an engineer at Monsanto Chemical, or a chemist there, give him a year of training and the stipends to go with it, and train that person to be a teacher.

But, clearly, the more we can encourage cooperation, that is to everyone's benefit. It is to the benefit of industry; it is to the benefit of our schools; it is to the benefit of the colleges.

Mr. **CHANDLER**. Well, I will continue to pursue this. The chairman of the committee, I am sure, will give us time to develop this legislation. We have already started working with the staff and Mr. Winn, in preparing an amendment that will be thoughtful and useful.

Thank you, sir.

Mr. **SIMON**. Let me just add, even the areas that are strictly the jurisdiction of our committee, I am willing to work with anybody if you have amendments that you think would make sense. Now, obviously, even if I think it makes sense, I want to clear it with my Republican counterparts on my subcommittee so that we have agreement.

But we have nothing written in concrete, and if you have some suggestions, we would be happy to work with you.

The **CHAIRMAN**. Thank you very much, Mr. Chandler. Mr. Lundine?

Mr. **LUNDINE**. Thank you, Mr. Chairman.

First I would like to say to the gentleman from New Hampshire and the gentleman from Pennsylvania, at least there are some people on this side of the aisle that do not want to look at this as a partisan matter and who are concerned about the haste and that it may make waste. At least, speaking for myself, I would like to make a sincere effort to produce the best product we can.

As usual, our colleague from Illinois has been a voice of reason here today, and I think maybe together we can persuade some in our party to allow some degree of reasonableness to enter into this product so it is not just a knee-jerk reaction.

The first question I would like to ask you, Paul, is about the scholarship selection. How do you do it? You got rid of this—if I may be allowed—cockamamie idea of Congressmen nominating people, but how do you make the scholarship selection in your bill?

Mr. SIMON. Well, it is on the basis of population. Each State submits—either the chief State school officer or the chief State higher education officer submits the nominations to a committee of 13 people, 8 of whom are public members, 5 of whom are Federal members. The real work would be some done under the direction of the Secretary of Education. They will have a staff to go through and sort out those whom the committee will select to be the recipients.

Mr. LUNDINE. The second area I would like to talk about is what has been nicknamed faculty flight, and there has been some previous talk about retention here, and obviously there are some who have provided great leadership.

You made the statement earlier, though, that obviously Congress cannot address the problem of pay of math and science teachers. I am not sure that we should set our sights so low. I am cognizant of the financial limitations in this emergency bill, but doesn't the summer institute program itself contribute?

We have had testimony before this committee before that, in the past at least, some of the institutes, if you can pay a math or science teacher to go to them, they serve a dual purpose, perhaps, of slightly increasing their pay and, second, providing some enrichment and some upgrading of their knowledge of their fields.

Mr. SIMON. That is correct. To that extent, we do get into the pay issue, so we do address the pay issue through the summer institutes, but obviously, it is going to be a 1-year increase for whoever attends although the benefits will be lasting.

Now, you do address the pay issues in the higher education institutions to the extent that they are able to keep faculty on for the summer who operate the summer institutes. But I do not want to fool anyone; it is not a very major contribution to faculty pay.

Mr. LUNDINE. As a follow-on to this legislation, I would hope that, as a leader in this area and as a member of both committees, you might work on some of these ideas that have been presented. The practical down-home advice I get from people in New York State, at least, is, frankly, they are never going to address that at the local level because of the collective bargaining process. I do not know that I am for a big-money Federal solution, either, but I would really feel a whole lot more comfortable with this if you would not consider it out of bounds and would consider some ideas that might address constructively, at least in the areas of science and math, the need to do something meaningful about salaries which will address this faculty flight.

Mr. SIMON. I am not opposed to it. I have to say again, it has traditionally not been an area the Federal Government has gone into. My guess is that the committee would be very reluctant to start getting into authorizing money for teacher pay, because once you start getting into this, you are getting into some real problems.

Mr. LUNDINE. But we have real problems in this country, real serious technological problems, and you have identified many of them today, and many basic education problems. I just think that the time for saying, frankly, the unions don't want us to get into that, may have passed, and maybe we have to face, not in a confrontation sense, but face up to some of these realities.

The final one I would like to question you about is what I consider to be a serious problem, and that is with scientific or technological literacy. All well and good that we are trying to do something about the 1 percent of people that go into science and math. How about the 99 percent of the people who are not going into it and are just totally illiterate with regard to technology? Is there anything in this bill or anything that you see as an immediate follow-on that can address this whole question of science and the citizen or whatever you want to call it?

Mr. SIMON. Yes, there is, and that is through the summer institute. If you check the language, we leave this open enough so that a summer institute may not simply be for science and math teachers. They may want to bring in fourth grade teachers to give them some basic expertise in this area of science and math so that they can start addressing the kind of problem at the elementary level that you are talking about.

Now, realistically, the bulk of the effort will be for science and math teachers themselves. But I assume that there will be—and we have purposely kept this thing open so that we can at least begin to address what is a very real problem.

Mr. LUNDINE. Thank you, Mr. Chairman.

Mr. Chairman, previously there was some talk about the North Carolina program. This committee was privileged last year to hear from the Governor of North Carolina about that. I would like to ask whether you would be open, on your hearings next week, to suggestions about witnesses, whether it be about that particular program or others.

The CHAIRMAN. Yes; I would.

Mr. LUNDINE. Thank you very much.

The CHAIRMAN. Mr. Walker?

Mr. WALKER. Thank you, Mr. Chairman.

Mr. Simon, I promised the chairman I would be somewhat more dispassionate this series than I was before. I do appreciate the reason for which you have approached this, and I would hope that maybe, out of this, you would carry back to your colleagues on the Education and Labor Committee the rather obvious bipartisan sentiment of this committee. This is something which we feel quite strongly should not replace the Japanese bullet trains with regard to speed of movement down the track; that here is something that, really, we feel we have a role to play, and that we would have some good suggestions for improvements in the bill, thus, making certain that we get a good bill.

I have a couple of questions that just address some general areas. The bill as I read it, 1310, has about $400 million in it. Now, if I understood you correctly, the administration's budget has approximately $50 million in it.

Mr. SIMON. Yes. I am not sure where you get the $400 million. It is $300 million.

Mr. **Walker**. Well, 1310, though, by the time you add on the title II section——

Mr. **Simon**. Oh, title II. I am sorry.

Mr. **Walker** [continuing]. Is another $100 million, so we are talking about a $400 million bill——

Mr. **Simon**. Yes.

Mr. **Walker** [continuing]. Compared to $50 million in the budget. Therefore, we come up with about $350 million of deficit add-on here. Has anybody talked about where we are going to find this $350 million?

Mr. **Simon**. I think the feeling on the part of our committee is that, when we are spending a lot of money in the area of national security, if anything is national security money, this is. If that means we have to take $300 million more out of the Defense Department budget, that is the best $300 million we can spend in terms of national defense.

Mr. **Walker**. Of course, the problem I have is that virtually everybody we hear around here is talking about taking money out of defense.

Mr. **Simon**. I understand.

Mr. **Walker**. The fact is, you could eliminate the whole defense budget and still have a deficit. So I have some problems with that, because that is everybody's solution to what we are going to do on the deficit side, and I have some problems with that.

Along with that, did the administration testify with regard to H.R. 1310?

Mr. **Simon**. They did. Now, when I say 1310, they testified on H.R. 30, which was the original bill.

Mr. **Walker**. And who testified on behalf of the administration?

Mr. **Simon**. Secretary Bell.

Mr. **Walker**. Secretary Bell. And did he make any comments with regard to the authorization levels and how he was going to fit those within the budget constraints of the budget that he sent up here?

Mr. **Simon**. I do not recall that there was any great discussion on the authorization level.

You are talking about authorization level. Let me mention one other area where we anticipate there is going to be a fairly substantial savings, perhaps as much as $900 million, and that is the drop in interest rates on guaranteed student loans, where we will not be spending what was originally projected.

Now, again, with deficits like we have, simply because $900 million becomes available does not mean we ought to be spending it; we ought to be reducing the budget. I think the fundamental question is, is this really of sufficient priority that this Nation has to move ahead on something like this? And I have come to the conclusion that we have to.

Mr. **Walker**. Isn't it true, though, that the administration has already figured some of those interest rate drops into its budget and part of the savings that it has in its budget?

Mr. **Simon**. That is correct.

Mr. **Walker**. So the $50 million allocation would have already assumed that as a part of its overall budget figure.

Mr. **Simon**. That is correct.

Mr. **Walker**. The other area that I would just like to explore for a moment on the money side is this issue that Chairman Perkins raised here earlier, and that is the fact that we had a program designed to do exactly the kinds of things that this program is. If I understood him correctly, he said that the reason why that program went wrong was because there was not sufficient oversight of those programs, and we allowed them to become of a more general use category and therefore lost the effectiveness of that which we put in place 20 or 30 years ago.

My question is, why aren't we looking at some basic reforms which he—it was his statement—admits that there was not sufficient oversight? Why don't we look at reforming some of those programs and getting them back to their original intent rather than going the route of simply adding on top of that which he is saying now raises some questions?

Mr. **Simon**. Well, many of these programs that he was talking about—and this predates my membership in Congress and your membership in Congress—were dropped along the line. For example, summer institutes were dropped. They really were an excellent program under the National Defense Education Act. They really helped teachers tremendously, and so we provided a significant amount, about 35 percent, of our part B funds for summer institutes.

Mr. **Walker**. Isn't it true that they were not dropped but they were folded into new programs?

Mr. **Simon**. Pardon?

Mr. **Walker**. Most of those older programs were folded into new programs, which I understood was what he was saying was the problem. We moved away from precisely the things that we originally created programs for, moved them into more general use programs, and as a result, the general use programs forgot the basic intent of what we set out to do in the late fifties and early sixties.

Mr. **Simon**. Again, on part A, I am not competent to judge. On part B, that would not be true.

Mr. **Walker**. Thank you, Mr. Chairman.

The **Chairman**. Thank you, Mr. Walker. Mr. Brown?

Mr. **Brown**. Mr. Simon, I really do not have any searching questions with regard to the bill.

Mr. **Simon**. Good! [Laughter.]

Mr. **Brown**. But I wanted to just elicit from you a few comments with regard to your idea about the relative role of the community colleges in this overall science education program, and the degree to which there is assistance.

We sometimes forget that in between the base of a scientifically literate citizenry and highly qualified engineers at the top, there is a large stratum of technically trained people who have to fill what you might call the subprofessional jobs of society. There are actually more of those needed than there are engineers and scientists. The role of training them is quite frequently in the community colleges of this country.

How do you see the importance of this particular segment of the job, and what provisions are made for it in this legislation?

Mr. **Simon**. We talked about that. There are some provisions that can help in the higher education end to upgrade. You are absolutely correct that that is an important part today. The majority of freshmen in college today, for example, are in community colleges, and it is the community colleges, by and large, that we train our X-ray technicians, our dental technicians, and so forth.

But what we are really talking about here is the science and math teachers. Other than the faculty at the community colleges, this bill starts at the junior level in college with the scholarships and grants and does not help that freshman in a community college in California and Illinois.

The theory was—and our colleague, Bill Goodling, felt very strongly on this—that if we want to have maximum impact, if we start at a little higher level, you are not going to have a lot of loss of people who just do not make it through college.

Mr. BROWN. Don't we have a provision in here that allows teachers already teaching to receive a grant for one year of additional training?

Mr. SIMON. That is correct, and that can be at the community college level, also. We also have provisions in here for improvement of the faculty, other provisions for improvement of the curriculum in colleges and universities, and community colleges can take advantage of that.

Mr. BROWN. I note that there is a provision in section 623 which has allocated 15 percent of the funds, and allows for 25 percent of that 15 percent to be made available for programs which are described as under title III of the Higher Education Act of 1965. I am told is community colleges, black colleges, and small colleges. Am I correct?

Mr. SIMON. That is correct. It is not exclusively community colleges, but community colleges are one of the major beneficiaries of title III.

Mr. BROWN. My main criticism of this bill, which I offered before the Education and Labor Committee, was that it still smacks of tokenism a little bit, in view of the fact that it is such a small amount of money overall for a very large problem.

And yet, as I reflect on the matter, I am inclined to feel that one of our problems here in Congress is that we think we can solve a problem when all we can really do is point the direction of a solution. I think, if we look at this bill as pointing in the direction of a solution, we will not get quite so frenetic about tailoring every comma and semicolon to reflect our perception of perfection in solving the problem.

I am reminded, if I may just relate an anecdote, of a high school in what was once my district which had the highest dropout rate almost in the Nation—low socioeconomic area, 90 percent Hispanic, and very little achievement in any field. Then, last year, they had the national distinction of having a couple dozen of their students qualify amongst the highest in the Nation on math tests.

The people giving the tests thought there was fraud involved and insisted that they take it over, and they still came out the highest in the Nation. It was not because of a Federal aid program but because of one good teacher who insisted that those students learn math and who motivated them.

So if we can motivate the country, through this bill, to understand that this is an important thing, we will be making a contribution. We are not going to solve the problem with this or probably anything else that we do. You may comment on that.

Mr. SIMON. Yes. I agree completely. I think what we need to do is send a signal to the Nation, The United States Congress thinks this is important. You can call it tokenism or whatever, and we can disagree. Our good friend from Pennsylvania thinks it is too much; others say we are not doing nearly enough. But we at least send a signal to the Nation that this is important.

The other point you mentioned is absolutely true. You find a school where students are achieving, whether it is science, math, foreign language, English literature, or whatever it is, and you are going to inevitably find one teacher that really inspires and sparks those kids.

Mr. BROWN. If I may make one final comment with regard to our friend from Pennsylvania, last year and the year before he insisted that there be no money for education in the National Science Foundation budget because his President didn't think we needed to give that kind of a signal. Fortunately, our President now feels we do need to give that kind of a signal, and the gentleman from Pennsylvania, in his wisdom, has decided his President is right and will support a reasonable program, and I commend him for that.

The CHAIRMAN. Mr. Lewis, do you have any questions?

Mr. LEWIS. Thank you, Mr. Chairman.

Just one question that I would like to ask Mr. Simon. Why don't you have a sunset application in the bill?

Mr. SIMON. Well, we do, don't we?

Mr. BLAKEY. The bill's authorization is for only 2 years.

Mr. SIMON. Two years.

Mr. LEWIS. Two years.

Mr. SIMON. A 2-year authorization.

Mr. LEWIS. So, at the end of 2 years, this bill then would have to be reenacted?

Mr. SIMON. Reauthorized.

Mr. LEWIS. Is there any way that your committee is considering more funding for the bill? I have been trained in the same State legislature as Mr. MacKay has, we have these beautiful programs sent to us in the State of Florida. I am sure the other States feel the same way. Then the money is cut off during the next biennium or the next additional budget. So, although we are all planned programed and moving, we do not then have the money This concerns me about this bill.

Mr. SIMON. Right. One of the reasons for the 2 years is, in 1985 we have to reauthorize the Higher Education Act then, and presumably some of what we have here can be included in the reauthorization of the Higher Education Act. That ordinarily is a 5-year reauthorization.

Mr. LEWIS. I see. Thank you.

The CHAIRMAN. Dr. Mineta. [Laughter.]

Mr. MINETA. Thank you very much, Dr. Fuqua. [Laughter.]

Mr. Simon, I want to commend you for the leadership you are showing in this area.

I come from an area that you are well aware of. It is the fourth largest city in the State of California, 14th in the country.

Mr. SIMON. What is the name of that city again?

Mr. MINETA. It is still the fastest growing. It is known as San Jose, Calif., but it is in the heart of Silicon Valley, and frankly we are eating our own seed corn. We do not have enough coming out of the secondary schools to supply the necessary labor for our high-technology industries. In 1982, "infrastructure" was the buzz word. In 1983, the buzz word is "high technology."

But we have been having to live with this thing in our area for probably close to 20 years. The other area that is lacking, or where we are desperately short, is in the ability to retain good people at the university level in the teaching corps, because our industries are able to get people, recruit people, by offering them a little more money and a stock incentive plan and draw them into their research and development areas.

I recently had a conversation with the head of the chemistry department at San Jose State University, who is recruiting at the instructor level at San Jose State University. He is looking for people with Ph.D.'s, and can only offer them $21,800. How we can attract people with Ph.D.'s in chemistry into the university system at the instructor level with that kind of salary system is beyond me.

I think what you are doing here is not laying margarine on the toast, but you are trying to target the resources at a problem area. I think the next area we have got to target is retention of people at the university level, to keep them there so that we are not eating our seed corn in terms of the future.

I support what you are doing here. We have heard all kinds of things about it is not comprehensive enough, and so we ought not to do it; we ought to intrude into the educational policy at the local school district level; we are not spending enough money.

But we cannot have it both ways around here, and I think this is a starting effort toward trying to draw together the number of interests that we have on this subject area. I think, with the kinds of comments that have been made here this morning, we will continue to make progress in trying to put something together that will be, "to use a lousy word, meaningful." But at least it is an effort to initiate a targeted program, not one that is just broad brush, but one that is targeted, and I for one would like to commend you and to work with you in seeking final passage of this bill.

The CHAIRMAN. Will the gentleman yield?

Mr. MINETA. By all means.

The CHAIRMAN. I might point out, one of the parts of the bill that has not been discussed is title II, which is solely within the jurisdiction of this committee, and it is contained in the language of the bill marked H.R. 1310 that deals with the part the gentleman is talking about. It is targeted to graduate students, not baccalaureate but graduate students, to go on and complete their Ph.D. degrees, particularly in these areas, to be the researchers and the professors in the universities in the years to come, because, as the gentleman points out, that is a very serious situation.

There was a bill that we had that came out of this committee last year, and it is back in the bill this time, with only that provision.

Mr. GREGG. Will the gentleman yield on that point?

Mr. MINETA. Surely.

Mr. **Gregg**. I would like to ask the chairman a question about that, because I have been looking at title II. One of my concerns is that it is extremely general, especially on page 16 in the first four lines, which seem to be the real guts of the authorizing language. That is extremely general. It includes capital equipment and instrumentation, which are important issues, but I am not sure they are the issues we want to address, mainly that is retraining and maintaining of math and science teachers. I agree with Mr. Mineta's concerns about having instructors at the college level.

I guess my question is, where do you perceive that this title II addresses the issue in specifics that you are referring to?

The **Chairman**. Well, I think it is all interrelated to title I, both parts A and B, but also title II deals with a very serious situation as it relates to colleges and universities.

Mr. **Gregg**. But I guess my question is, I don't really see that language in there. I think there is lot of posturing language in here, but there is no specific language which directs that the NSF shall use those funds for anything other than the very broad statement that it is to be expended on moneys for grants, research fellowships, capital——

The **Chairman**. I think we will offer an amendment to this to direct some priorities.

Mr. **Gregg**. Well, that was going to be one of our concerns, quite honestly, and I look forward to the chairman offering such an amendment.

The **Chairman**. That would stress precollege science and math training and industry exchange, instructional instrumentation, development for higher education, with special emphasis on computer literacy, faculty development, and technician training in engineering and high-technology fields in 2- and 4-year institutions and young engineering faculty retention.

Mr. **Gregg**. Do you think, Mr. Chairman, there is any chance that the minority could work with you on that, the development of that?

The **Chairman**. I would certainly hope so and would encourage it.

Mr. **Gregg**. Thank you. Thank you very much, and I would ask unanimous consent that the gentleman from California be granted 3 additional minutes for the time I just took up.

The **Chairman**. Yes. We will not take that out of your time.

Mr. **Mineta**. Really, I appreciate my colleague from New Hampshire on this score, but I have nothing more to do other than to commend our colleague from Illinois for 3 minutes for his efforts.

Thank you very much.

Mr. **Simon**. If I could just thank my good friend from California and say I think his phrase is absolutely apt: We are eating our seed corn. That is exactly what we are doing.

The **Chairman**. Mr. Reid.

Mr. **Reid**. Thank you, Mr. Chairman.

I will take the gentleman from California's time to praise you for 3 minutes. I think, Mr. Simon, that you are to be commended for the work not only in bringing the bill to us but taking the time to testify here today.

I have just a little different feeling than a lot of the members. I served in a legislative body a number of years ago, and since that time I have watched the legislature, and I think the only people that think the legislature moves too fast are those people in the legislature. Everyone else thinks it moves like a turtle. I do not know who is responsible for pushing this legislation along, but I hope they continue to do so, because if there were ever an emergency situation in this country, it is the pathetic situation we have at all levels of our educational institutions regarding science and math.

It is easy for us to say things like we don't have enough physics teachers to teach physics. But when you start giving statistics like you gave—and I was home recently, and one of the math teachers told me that we have less than 15,000 physics teachers in the entire country. Now, I do not know if that is right, but I do know that we have very few physics teachers.

I think that we should continue to push this. I would say to both the chairmen of the respective committees that chairmen, in my limited knowledge, are damned if they do and damned if they don't. If they don't push something fast enough, everybody is upset at them; if they push something too fast, then there are clamors of concern.

I would respectfully suggest that this part of the bill that you are concerned with should be limited to science and mathematics and exclude everything else from it. It is a limited amount of money anyway, and I think that that would strengthen the purpose of the bill.

I would also suggest that, as the gentleman from Oklahoma suggested, this should be loans and not scholarships. That way we don't have problems in repayment, which has caused a great deal of concern with people throughout the country as to people not paying these back.

I would also suggest that there should be language in the bill to make sure that the years that they teach are consecutive in nature, so that there cannot be a legal point raised that, I am going to complete teaching later on; therefore I don't have to pay it back because my educational abilities are still available to students.

I would parrot what the gentleman from California said. Of course, there are all kinds of things wrong with the bill if we wanted to so-called nitpick the program. But I think the main direction of the bill is excellent, and I don't know of anything in this Congress that is more important to the people of this country from a defense standpoint, from an educational standpoint, or anything we want to talk about, than this bill to do something about the situation we have in science and mathematics.

As far as the partisanship of the proceedings, we all recognize that we cannot afford to be partisan, because once we get the bill through here, we have got to go to our colleagues in the other body and get their help, and that is controlled by the other party.

Mr. SIMON. I thank you very much. I always appreciate hearing from a former Lieutenant Governor. [Laughter.]

Let me just make two quick comments. No. 1—and Dave McCurdy knows this much better than I do--but I have served on the security task force of the Budget Committee, where we have gone into a problem. Our No. 1 problem in defense is personnel. If you are talking about defense needs, to prepare the kids in this Nation so they have more knowledge in math and science so they can understand how to operate a TOE missile is just fundamental in the area of defense.

The second point you mention is an extremely important one. I would differ on not including foreign languages, incidentally, for reasons I spelled out earlier. But the time factor is important from this angle, and that is that if we want to have the summer institutes operate this coming summer, then we have to pass something before too long. If we don't get a bill passed and signed by the President until next May, for example, for all practical purposes, that rules out summer institutes for next summer.

The summer institutes look to me like the one area where we can have an immediate infusion of upgrading into the quality of math and science teaching.

Mr. REID. At least, Mr. Simon, I think we should eliminate "Or other course of study," and there is other language in here, "Or other appropriate subject." So let's limit it maybe to science, math, and foreign language.

Mr. SIMON. I am willing to chat with you about those possibilities.

The CHAIRMAN. One of the questions raised by Mr. Walker, Is there money in here for 1983?

Mr. SIMON. Well, that is a good question. No. OK, so we are not really talking about the summer of 1983, anyway. The summer of 1984 would be our first opportunity.

Mr. WALKER. That is the reason why we have plenty of time.

The CHAIRMAN. I might point out, you mentioned, Mr. Simon, the military. Last year, when we had hearings on the bill that I and many others had introduced, which is now title II, General Marsh, who is the commanding general of the Air Force Systems Command, testified in support of that bill and stated the Air Force alone, his department, was over 10 percent short of qualified officers in the math, science, and engineering area, just to manage contracts that the Air Force has. You know, they have contract officers that are stationed with the contracts to make sure that the Government is represented and the contracts are being performed according to specifications, and particularly in technical areas.

He said it was a severe impairment to the Air Force to be able to operate under these types of conditions. Many of the people, after they were trained, would seek jobs in private industry, where the funding was much more lucrative than maybe in the military services. For that matter, he was also concerned about the shortages that we have just in faculty engineering in our colleges today. We have almost a 10-percent shortage of faculty engineers right now in colleges that have been identified.

People such as the American Association of Mechanical Engineers, engineering societies, and others testified in some rather extensive hearings that we had last year on this very subject, and I would suggest to some of the members, particularly the newer members, to maybe get that testimony and review it and see some of the information that we received from people that are at the front lines. The president of the American Association of Land-Grant Colleges and Universities testified, the AAU, I think just about every organization I can think of.

There have been several task forces, one headed up by Dr. Ed David, who is former science adviser to President Nixon and now senior vice president for research for Exxon Corp.; the president of MIT, and I could go on and on. I have been all over this country to meetings relating to this very subject matter, and there is a great deal of concern about where we are going, particularly in the field of higher education.

It also gets back to the secondary schools as well as science teachers, and all are related. They are all related to a very significant problem that we have facing us.

Are there any further questions? If not, Mr. Winn had an observation.

Mr. WINN. Thank you, Mr. Chairman.

Mr. Chairman, this has really been an enlightening hearing this morning. We have taken just about 2 hours and 15 minutes.

It is obvious that there is a lot of interest on both sides of the aisle in this problem. There have been some insinuations in the last few hours and prior to the hearing, that possibly the minority was trying to stop this bill. That is not true. It is obvious, by the questions, it is obvious, by Mr. Chandler, Mr. McCandless, Mr. Gregg, and Mr. Walker and the various members on our side of the aisle that have put forward some constructive suggestions.

Mr. McCurdy has given, really, the minority position in this hearing this morning.

Mr. McCURDY. Now, you are going too far, Mr. Winn. [Laughter.]

Mr. WINN. But we appreciate it, and we will adopt your quotes, if I may, Dave, when you said, "Let's slow down this speeding train." That is all we are talking about. And you also said, "Let's do it right." I am convinced from this discussion this morning that members from both sides want to do it right, as does Paul Simon, who is always very, very thorough.

We have 14 new members of this committee, Mr. Chairman, who have sat through most of this testimony this morning. Many have participated. They had not seen the bill prior to yesterday or today.

I would like to point out, if I may, that there is no Senate action planned on this bill, certainly any immediate action, that I think would warrant this hurry-up job. We do not want to be partisan about it, but I would have to point out that in 1310 there are no Republican cosponsors of that bill. So that bill does look like to me that it is partisan, but it is obvious in the Science and Technology Committee that the interest and the enthusiasm and the constructive suggestions that have been made this morning are not partisan in any way.

Mr. MacKay expressed his concern about the haste of this bill. Mr. Lundine said we have got to have the best product that we can. I would just like to point out, Mr. Chairman, that I know you are under the gun, and I appreciate your saying at the start of the hearing this morning, as per our agreement, that there would be no markup. I just cannot believe that we would even consider a markup, certainly after hearing 2 hours and 15 minutes' worth of testimony, that we would have tried to mark this bill up this morning. I think it would have been one of the greatest mistakes of the 16 years that I have been on the Science and Technology Committee.

We want to work with you, Mr. Chairman. If we can help bail you out with whoever is pushing this bill, give us more time. On the minority side, I can speak for Mr. Gregg and some of the rest of them. They are willing to take their weekends to try to get additional witnesses that might help with the input into the bill. I do not know what kind of attendance we are going to have next week because of the current rumors that we may have pro forma sessions all next week. That is going to make it pretty hard for members of both sides to get any kind of quorums, but I will guarantee you that we will dedicate the work of our staff people and as many of the minority members as possible to make this a bill that we can take to the floor, that we can support, that we will be glad to support, and that we will urge the President to sign, and that we will urge that there be some action or similar action in the other body.

I thank the chairman.

I also would hope that maybe, with the help of members of both sides of the aisle who are interested in this, the February 22 date could be pushed back. Although you have given me the reasons that we should head for that date—maybe we can get that date not to be so set in concrete with the Speaker or Mr. Wright or whoever is involved. If nothing else, maybe we can both visit them on that.

Thank you, Mr. Chairman.

The **Chairman**. Thank you, Mr. Winn.

Let me say that I think the Education and Labor Committee started holding hearings about January 3, and I am being somewhat facetious, but about the beginning of Congress, this session.

Mr. **Simon**. H.R. 30 was introduced on January 3 and we held hearings later in the month.

The **Chairman**. The Speaker and the leadership are very interested in getting this bill to the floor as soon as possible, hopefully before the social security bill gets on the floor, which is scheduled sometime the week of March 7. The following week, they hope to have, or following that, the first concurrent budget resolution.

Then we recess for a district work period and Easter the following week, the end of the week of the 24th. So that is part of the reason. We want to work with everybody. We want to make this a good bill. I think the Nation is looking to leadership from the Congress to do something about it. It is like the weather: We have talked about it enough; it is time we did something about it in a positive fashion.

I hope that we will have a hearing next Wednesday. We will have a number of witnesses, and if you have witnesses that you would like to have heard, please talk to Dr. Poore and we will try to schedule them, and I will even hold hearings on Thursday if necessary.

And then Tuesday we will start marking up the bill, and we will proceed under the rules in an orderly fashion, and all amendments that are germane to the parts that are within the jurisdiction of this committee will have an opportunity to be heard and voted on at that time. We will try to expedite the work of this committee in getting the bill to the floor in cooperation with the Education and

Labor Committee. They have been most cooperative in trying to resolve any jurisdictional problems. As I testified before Chairman Perkins, the only turf that he and I disagree on is about horseracing, whether they come from Mr. MacKay's and my district or Kentucky, and that debate will go on. But as far as this bill is concerned, there is not any problem with it.

So we do want to proceed in an orderly fashion and work with all members. If you have amendments, we certainly want to consider them. I do not think that the wisdom of this committee is always centered at the chairman of the committee or any other member. Every member can contribute and every member has an equal vote. We do want to work with the members on this.

Mr. Walker.

Mr. WALKER. Mr. Chairman, it seems to me that one problem with the date of the 22 is that in order to that, we will have to violate the rules of the House. We will not have the 3-day layover of the bill. We are going to be in a position of having to go to the Rules Committee, get a waiver on the rules, at the very least, which means that you could inspire a rules fight.

I think the point that some of us would make is that we can probably come out of this committee with a bill of general agreement. There seems to be general agreement with minority and majority in the Education and Labor Committee. We could probably come up with a similar kind of approach out of this committee that would allow us to bring this bill up under suspension and have a fairly noncontroversial bill.

It seems to me, though, that if you are taking it down such a track that brings about a need to waive rules and everything else to get it to floor, we are just asking for some controversy that probably the topic does not deserve.

I am just wondering if the leadership cannot be prevailed upon to at least see that here is something where the kind of cooperation that would be inspired would be a real signal to the Nation. Paul Simon has put it well. You know, if Congress wants to signal to the country that this is something that needs to be done, and if we are doing it with reasonably minimal funding, then at that point it seems to me that there ought to be as united a front as possible. We have the potential of achieving it on this bill; it is just difficult to achieve it within the timeframe that we have been given.

I would suggest that if we could do it in a way that we do not end up in violation of the rules, it would certainly serve the best interests of the overall topic and the overall goal that we are trying to achieve.

The CHAIRMAN. Well, the gentleman makes a very good point, and I will certainly discuss it with the leadership and try to persuade them that if we can act in an orderly fashion I think we will have a much better product. But I am not sitting in that seat and I have not been elected Speaker. But I will certainly relate that. The Speaker has been very accommodating already about the bill. But they would like to move on it prior to the social security bill.

Mr. **Walker**. I thank the chairman.

The **Chairman**. The committee will adjourn until 9:30 Wednesday morning.

[Whereupon, at 11:26 a.m., the committee recessed, to reconvene on Wednesday, February 16, 1983, at 9:30 a.m.]

H.R. 1310, EMERGENCY MATHEMATICS AND SCIENCE EDUCATION ACT

WEDNESDAY, FEBRUARY 16, 1983

House of Representatives,
Committee on Science and Technology,
Washington, D.C.

The committee met, pursuant to call, at 9:30 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman of the committee) presiding.

The Chairman. The Committee on Science and Technology meets to hear testimony from witnesses representing various sectors of the education community on H.R. 1310, and before that, without objection, permission to record and take photographs, both still and moving, will be permitted.

The bill, H.R. 1310, involves mathematics, science, and engineering education, as well as personnel. We are fortunate to have the benefit of an outstanding group of witnesses who are involved in industry and education. I want to commend our colleagues on the Education and Labor Committee for their quick action in response to the needs of the Nation and following the initiatives proposed by the last Congress in this vital area.

By working together, the Education and Labor Committee and the Science and Technology Committee will bring before Congress a comprehensive bill dealing with the needs of science and engineering education.

In his state of the Union address, President Reagan highlighted the importance of science and mathematics education in our Nation's prosperity.

On February 3, the President's science advisor, Dr. George Keyworth, stated in testimony to this committee that the single most important investment for our future is the education of our youth. This is a unique time in which there is unanimous recognition by leaders in government, industry, and education that science and engineering education and personnel are of crucial importance for the future. The time is now for decisive action by Congress.

By combining the programs for precollege and postsecondary education with a special engineering and personnel fund to help foster the quality of science personnel, H.R. 1310 represents a start in our response to the current situation.

H.R. 1310 alone is not the final answer, but is a necessary beginning. This bill represents action the Federal Government can take and I hope it serves as an impetus to State and local governments to take action, since the fate of the Nation's education system is largely in their hands.

The bill reflects a balance between programs and initiatives proposed for the National Science Foundation and for the Department of Education. I think this hearing will provide us valuable information and I look forward to hearing our witnesses give the committee further guidance in perfecting the bill.

Again, I want to thank our witnesses for joining us here today and we look forward to hearing from them.

Without objection, I would like to insert into the record a statement by ranking minority member, Mr. Winn, and then I would like to recognize Mr. Gregg for any comments that he wishes to make.

[The opening statements of Mr. Winn and Mr. Walgren follow:]

OPENING STATEMENT OF HON. LARRY WINN, JR.

Mr. Chairman, I am very pleased to be here today and even more pleased to see the full schedule that we have in front of us for this one true day of hearings on this important issue. Given the large number of witnesses, I will make my remarks brief but I want to make a couple of points.

First, Mr. Chairman, I want to congratulate you on arranging for this day of hearings. As you know, the fast track schedule on this piece of legislation initially called for both a brief hearing and a markup last Wednesday. While this one day of hearings is no substitute for the careful and extensive consideration that this issue should receive, it is better than having no real hearings at all.

Second, it was my opinion, based on our hearings of last week—and I think this view is shared by almost everyone who was there—that considerable improvement is needed in H.R. 1310 either through amendments in this Committee, or in those Education and Labor areas we cannot touch through amendments on the Floor. I am certain that our many witnesses today will have several constructive criticisms of the bill. I look forward to their testimony as an aid in drawing up the proper amendments to offer at markup next week.

Thank you, Mr. Chairman.

OPENING REMARKS OF REPRESENTATIVE WALGREN

Mr. Chairman, today we begin the second day of hearings on H.R. 1310 before the Committee on Science and Technology. Last week we had the pleasure of a dialogue between our colleagues Carl Perkins and Paul Simon of the Education and Labor Committee and this Committee on the portion of this bill developed under their able leadership. Today we will hear testimony from a broad spectrum of witnesses on the merits of the bill.

Mr. Chairman, during the last session of Congress, the Subcommittee on Science, Research and Technology held extensive hearings on our nation's problems in science, engineering and math education and manpower. We heard from almost thirty witnesses including a U.S. Senator, presidents of colleges and corporations, an award-winning high school student and educators from many organizations. This testimony conviced most of my Subcommittee and me that the problems facing this nation in math, engineering, and science education and manpower are severe and need our immediate attention. The testimony was overwhelming in this regard.

This bill before us today, H.R. 1310, has been drafted by the Science and Technology and Education and Labor Committees to be a multi-faceted attack on the problems in science engineering and math education and manpower. We all realize that this bill is not perfect, but I believe it is a good bill, and I look forward to the witnesses helping us make it a better one.

Mr. Chairman, I am particularly happy to join with you in welcoming Representative Mills of the Florida House of Representatives. I am also very pleased to welcome Dr. Van Horn of Carnegie-Mellon University and Dr. Holland from Allegheny County Community College, both from my own city of Pittsburgh. I look forward to hearing their testimony.

Thank you, Mr. Chairman.

Mr. GREGG. Thank you, Mr. Chairman. I would like to express my appreciation and the appreciation of the minority for your holding these hearings and the excellent group of witnesses which have been put together, both by minority and majority staff.

This is an extremely important issue, as I think we all recognize. I believe that we have the foundation for building a very strong and effective bill in this issue and I look forward to the testimony today to affirm where we should go with 1310.

I would also like to make a correction for the record. That is that at the prior hearing when Chairman Perkins came before us, I represented, and inaccurately, that there had been no request of the minority to appear before this committee, relative to 1310. This was an inaccurate representation. I find out now that the letter was sent out by his committee with adequate notice relative to the hearings and, therefore, I apologize to the chairman on that point.

The CHAIRMAN. Thank you very much.

I think we will take the witnesses, first of all, we will hear from our colleague, Hon. William Goodling, from Pennsylvania, who is one of the senior members of the Education and Labor Committee and one who has been very much involved and interested in the field of science and education and one we are very happy to have.

He succeeded his father in Congress, who was not only a very outstanding young man, but one that I was privileged to call a very close friend.

Bill, we are happy to have you following in some big shoes and doing a fine job.

STATEMENT OF HON. WILLIAM F. GOODLING, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF PENNSYLVANIA

Mr. GOODLING. Thank you, Mr. Chairman. I will not try to fill those shoes, I know that is not possible, but I will just plug on and do my best.

I am happy to be part of a team effort. We have several committees trying to come up with some solutions to some very serious problems. I am not going to read my testimony now. It is hot off the press, and we noticed coming over here that in the first paragraph, we have a typo, but I think you will know what the word means.

Rather, I would like merely to say that we on the Education and Labor Committee, particularly the Elementary, Secondary, and Vocational Education Subcommittee, have worked to try to bring about a bill that we thought would serve the needs of the masses, the needs of the majority of the American people.

As you may remember, we got excited a couple of decades ago when Russia launched Sputnik and we came up with NDEA, the National Defense Education Act. In my estimation we spent a lot of money—money that did not put us on the Moon. We had all the technology and all the brain power available to get to the Moon before NDEA. All we had to do was make a commitment and turn our scientists loose with the money and manpower to get there.

But we went ahead with NDEA anyway and in my estimation, we just made the elite in the science and math areas more elite, and we did nothing to improve the illiteracy of the general population.

In considering the current math and science education problem, the Elementary, Secondary, and Vocational Education Subcommittee has decided that we need to focus on specific priorities because, although $400 million sounds like a lot of money, it is really just a drop in the bucket. Rather than try to do all things for all people, we have tried to address particular concern.

We listened to testimony from approximately 50 witnesses. We received 50 different ideas of what the problem is and 50 different solutions as to how one solves that problem. In fact, some indicated that we did not have a math and science education problem, and therefore, we should not be involved in trying to solve it.

When we were finished listening to all the testimony, we thought that our effort on the Education and Labor Committee should be geared toward trying to bring about literacy in the area of math and science throughout the entire population of the United States.

Estimates are that 90 to 95 percent of the population is illiterate in to math and science terminology and technology and thus in the ability to do much in those areas.

On page 4, of my testimony, at the bottom, I indicate that we have worked hard in subcommittee to improve H.R. 30, which is now title I of H.R. 1310. It is not the exactly the piece of legislation that I would write if I had my way, but it is a bill that I think is of critical importance.

The major focus in title I, part A, is on upgrading the skills of current science and mathematics teachers.

Part B expands this upgrading of current science and mathematics teachers to bring new blood into the teaching of science and mathematics, among other things.

We have determined that if we do not do something to help the elementary teachers who had very little math and science in college, except one course on how to teach math and one course on how to teach science, we are really not going to be successful in making the American public more knowledgeable and more literate in the areas of math and science.

So part of our effort is to upgrade the ability of elementary and secondary teacher to teach those subjects, and also to try to bring new people into the teaching field.

There are two parts of H.R. 1310 which I would eliminate if I could, but unfortunately, we did not succeed in doing so in my committee. I think we lost by one vote in committee on the foreign language part of the bill. We prevented it from being inserted in the elementary part of the bill, but it remains in the postsecondary portion.

I believe that we should have eliminated the foreign language item because, first, we did not hold any hearings on that particular issue, and second, because we have so little money to work with that if we are going to add foreign language to the math and science thrust, we are going to reduce our effectiveness by spreading our funds too thinly.

The second item that I would have changed is the scholarship program to exclude juniors and seniors in college. It is my belief that you really do not know whether or not you have potential teachers until they have completed their student teaching. They could be brilliant math and science scholars yet be lousy in front of a classroom. You don't know until they've actually tried to teach, as my 23 years as an educator, a principal, and a superintendent have shown me. My hope would be that we would concentrate on those who have great potential.

Our goal is to attract people who need certification improvement. Because of declining enrollments we have teachers who are certified in general science but who are stuck teaching one course each in physics and advanced math without possessing the necessary training.

We would hope that with our scholarship program, we would encourage some of those people to come back for training to prepare themselves to teach these advanced subjects.

The administration's bill did not go far enough in this area, however, it's on the right track. They are also trying to bring back into the teaching field some fine math and science scholars who, because of cutbacks, because of many other things, find themselves without a job at this particular time.

There is one other area that I would encourage you to look into in your committee, specifically in title II. I hope that you would not overlook the role that the National Science Foundation has played in supporting public service television. I think they can play a real role in this endeavor to improve that 90- to 95-percent illiteracy rate that we have in the areas of math and science.

I think those are the areas that I wish particularly to cover this morning. I would be happy to answer any questions. One more item—I think one other committee has to join us in this effort, and that is the Ways and Means Committee. I think we need tax credits. The only way I can think of to try to compete with the private sector when you are talking about money to pay teachers, is through a tax credit program. Somebody testified before our committee and said, well, we have to pay math and science teachers more. Again, as a superintendent of schools, I hate to think of that poor superintendent or principal who is stuck with paying math and science teachers one price and the person who is doing an outstanding job next to them in another field, a different price.

However, as I suggested to the NEA, we can give additional money to those teachers who are doing an outstanding job in every field rather than giving the same amount of money to everybody, regardless of whether or not they are carrying their weight.

In that area, we need the Ways and Means Committee. I think we also need the Ways and Means Committee to bring the private sector into the search for a solution to our problem.

The best testimony that we get on our side generally comes from the Superintendent of D.C. schools. She does not come in and hold out her hands and say, "What I need is more money." She comes in and tells us what she is doing and, in listening, I have a feeling that her students will be better prepared for the years ahead than many other students because she has forged a real relationship with the private sector and is getting advanced technology and hands-on opportunities for her students that most students never get.

So I think we have to develop a tax credit program to bring the private sector into a closer relationship with the schools in the areas of sharing equipment and sharing expertise. We need to promote personnel exchange—people coming in and teaching, and our people going from education into the private sector for short periods.

Those are some of the areas that we are trying to deal with. I think it is critical that we work well together and as I said, if we can include Ways and Means in this, I think we can go a long way toward solving some of the problems with which we are faced.

I would be happy to answer any questions, Mr. Chairman.

[The prepared statement of Mr. Goodling follows:]

Statement of the Honorable William F. Goodling

on H.R. 1310, the Emergency Mathematics and Science Education Act before the Committee on Science and Technology

I appreciate the opportunity to testify today on what I consider to be a vital piece of legislation. From my perspective of twenty-three years in education as a teacher, counselor, principal, school board president and school superintendent I am well aware of Federal programs that have worked and those that have not. In addition, as the senior Republican on the Elementary, Seconcary, and Vocational Education Subcommittee, I feel that I have gained some insight which may be useful to Members of this Committee as you consider H.R. 1310.

My purpose here today is to urge both prompt and careful deliberation by this Committee on H.R. 1310. I am sure that, by now, you are aware of the alarming facts regarding the problems this nation is currently facing in the area of science and mathematics. As noted in our Committee report on H.R. 1310, most States are suffering shortages of mathematics and science teachers and in some States the shortages are critical. Of 45 States responding to a national survey, 43 reported shortages of mathematics teachers, 42 of physics teachers, and 38 of chemistry teachers. Over the past decade, the number of secondary level mathematics teachers being trained in colleges and universities declined 77%; the number of science teacher candidates declined 65%.

Stopgap efforts to abate the shortages have resulted in underqualified teachers being hired. Of the teachers newly employed in 1981-82 to teach high school mathematics or science, 50% were formally unqualified and teaching with emergency certificates. Recent figures from the National Science Foundation indicate that 16% of all elementary school teachers are not prepared to provide basic instruction in science and mathematics. I would like to stress that solid background at the elementary school level is essential if we ever hope to turn around our current decline.

Student Preparation and Achievement

The number of students taking advanced mathematics and science courses is dropping, along with the overall level of students' achievement in these subjects.

One-half of all U.S. high school students take no mathematics or science beyond the 10th grade. Only 34% of our high school graduates have completed three years of mathematics, and less than 20% have taken three years of science. Only 8% have taken calculus.

According to a survey of the National Science Teachers Association, some 32,000 classes in science and mathematics which were needed for school year 1982-83 could not be scheduled for lack of teachers or resources. Some 640,000 children who wanted to take science or math were required instead to take courses in other subjects for which no teacher shortage existed. The unavailability of courses is particularly acute for the most advanced levels. There are only 10,000 high school physics teachers for the nation's 16,000 school districts, and fewer than one-third of the school districts offer physics courses taught by qualified teachers. Calculus is taught in only 31% of United States high schools. When courses are taught by under-qualified or out-of-date teachers, working with substandard materials and equipment, this undoubtedly affects students' motivation to pursue additional courses in these subjects.

been recognized by individuals across the political spectrum, throughout the regions of the country, and in many professions. President Reagan, in his 1982 convocation address to the National Academy of Sciences, declared:

> The problems today in elementary and secondary school science and mathematics education are serious--serious enough to compromise America's future ability to develop and advance our traditional industrial base to compete in international marketplaces.

As our Committee report states, the crisis in mathematics and science education demands solutions from all levels of government, local, State and Federal. Some facets of the problems are more appropriately addressed at the State or local level; for example, setting of requirements for graduation or determining teacher salaries. But State and local governments, given their wide disparities in available resources and limitations in coordinating across jurisdictions, cannot solve these dilemmas alone. There is clearly a role for the Federal government, to focus national attention on conditions that affect all parts of the country, to coordinate efforts from a national perspective, to encourage other levels of government to seek solutions, and to provide aid toward some possible remedies.

We worked to improve H.R. 30 which, of course, has become Title I of H.R. 1310. While it is not the exact piece of legislation I would write if I had my way, it is certainly a bill that I think is of critical importance. The major focus of Title I, Part A is on upgrading the skills of current science and mathematics teachers. Part B expands this upgrading of current teachers to, among other things, bringing "new blood" into the teaching of science and mathematics. I encourage this Committee, which has joint jurisdiction over Part B, to keep the focus on the summer institute program.

The dilema persists at the postsecondary level. According to a University of California survey, 92% of the women and 43% of the men in the freshman class had already disqualified themselves from three-quarters of the possible majors for lack of sufficient mathematics. Another national survey of probable majors of entering freshmen indicated that in 1970, 52,400 college and university freshmen planned to major in mathematics or statistics. By 1980, the number had plummeted by 80%, down to 10,250.

The National Assessment of Educational Progress found a steady decline in the science achievement scores of U.S. 17-year olds, as measured in 1969, 1973, and 1977. The National Assessment data reveal some particularly disturbing trends relating to the "higher order" skills, such as mathematical problem-solving, and to the "high-achieving" students (those in the top 25%). Most 17-year olds demonstrated a lack of basic mathematical problem-solving skills; for example, 58% were unable to find the area of a square given one of its sides. In the aforementioned assessments of science, the decline for higher-level science skills was found to be twice as great as the decline in the lower-level skills. The assessments also show the academically able students losing ground. The mathematics and science skills of high achievers at all three age groups measured fell during the past several years, dropping by a range of 2.5 to 4.3%.

Need for Federal Legislation

As vividly demonstrated by the above statistics, our nation confronts serious, widespread problems in mathematics and science education. These problems pervade elementary, secondary, and postsecondary education. They affect teachers, students, employers, and the military. Their severity has been recognized by individuals across the political spectrum, throughout the regions of the country, and in many professions. President Reagan, in his 1982 convocation address to the National Academy of Sciences, declared:

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I do have several concerns over Part B which I would like to share. First, I cannot endorse the plan to include teachers of foreign language in this legislation. If there is one way to destroy a program it is to weaken and dilute its focus. This is especially true in a time when we are facing severe budgetary problems. This legislation is an emergency package designed to deal with the cirtical problems in mathematics and science. I know that my colleague Paul Simon, who is a member of both the Education and Labor Committee and the Science and Technology Committee, is deeply committed to addressing the foreign language problem. I respect his opinion and I concede that a problem in the foreign language area does exist. However, I am convinced that H.R. 1310 is not the appropriate vehicle to address such a concern. I hope that the final version of the bill keeps its focus and directs our limited resources entirely toward the mathematics and science problems.

In addition, I hope that the Teacher Scholarship Program in Part B of Title I can be more highly targeted on the recertification of current teachers and college graduates. I fear that too much time is involved in developing postsecondary scholarship programs for potential teachers. I see this legislation as an emergency measure and not as a permanent program. In addition, our problem is not a shortage of teachers but rather a shortage of teachers who are qualified to teach mathematics and science. Retraining teachers and college graduates who are not now teaching appears to be a more efficient use of resources than an undergraduate scholarship program.

In considering Title II of H.R. 1310, the Fuqua bill (H.R. 582), I hope this Committee will not overlook the role that the National Science Foundation has played in supporting public service television. This activity has played a critical role in providing a consistent source of quality science information to the American public.

In closing, I would like to thank the Chairman and Members of the Committee for providing me with this opportunity to share my views.

The **Chairman**. Thank you very much, Bill. Let me just say that I certainly concur with the points that you made about the overall concept of the bill. I am sure, as you pointed out, it is not a perfect bill that anyone would have written himself, but in the legislative process, we have to work with all the members and come up with what we generally think they would support.

The part you mentioned about the Ways and Means Committee, and I think that is the part of the bill that Mr. McCurdy has been involved in, and I am hopeful that can be taken care of in another bill and not subject this bill to any further delay.

Mr. **Goodling**. No, I do not think we should try at this point to tack it onto ours, but I think it is something we have to encourage. Both committees have to encourage them so we ultimately have a total package to deal with the math and science education problem.

The **Chairman**. Right. Thank you.

Mr. Gregg.

Mr. **Gregg**. Thank you, Bill. I agree with your concerns that you raised about the bill. I also feel it is a good framework to begin with.

One point that you make is that we are working with limited resources here, and we have got to sort of target those resources. In part A, I noticed that although you limit the amount of funds which can be used for administration, and I realize this is not our committee's obligation, but it is just something that stands out. You limit the amount of funds that can be used as administration at the State level to 5 percent. There is no limitation when the funds are passed through to the LEA, to the local educational agency, as to what they can use for administration.

In other words, they could absorb all those funds in studies, rather than getting it out into the field to support their teachers.

Mr. **Goodling**. I think we have language in the bill, in the report, that pretty well specifies what it is they are supposed to do with the money. It does not tie them down in precise terms, but it is still rather specific, I think. In writing legislation in our committee, we usually tie the limit on the State as far as administrative funds are concerned. We do not usually do that on the LEA level.

However, I do not believe they could do, Congressman Gregg, what you think—what you are saying they might be able to do, nonetheless it is something that we can look at and if we can tie it down more, we would be happy to do that to make sure that it goes to helping teachers and not merely for administrative and study purposes.

Mr. **Gregg**. One area that I also feel is an important way to reeducate, which is what you are talking about, our elementary and secondary teachers is through the summer institute program, which was so successful when it was functioning at top level.

I was just wondering if you could give us your views as to who should be operating this, whether it should be NSF or it should be Department of Education.

Mr. **Goodling**. Well, I think it should be a very close marriage. We indicate in our part of the legislation that the expertise for summer institutes certainly lies in the National Science Foundation. They know how to do it and we are not quibbling with that.

But I think that there has to be a close marriage between the Department of Education and the National Science Foundation.

Mr. GREGG. I also share your reservations about the foreign language. There is also another section in there that says, "or other areas of whatever you feel is a shortage, such as home economics." That language, obviously, has to come out.

On the foreign language issue, is there some middle ground here? I mean, can we settle on critical language such as Japanese and Russian and languages where we know we have a distinct shortage?

Mr. GOODLING. Let me say that I have the greatest respect for my colleague, Mr. Simon, and I know how he feels about the foreign language portion of the bill. I have indicated to him that when we have money available and we are through this recessionary period, I would love to work with him on the foreign language issue.

I do not really believe, first of all, that we understand what it is that we would have to do. I don't think we can realistically expect to bring about widespread bilingualism in this country.

My experience would indicate that after students have gone through a certain number of years of a foreign language, if they go to a foreign country for a semester where it is sink or swim, they come back able to speak the language. Yet they can spend 8 years studying, and many of you probably have, as I have, in American classrooms and never speak the language. I would hate to try to get by in Germany at the present time with my German in spite of many years of training in that language.

So, because I do not think we really understand how to tackle that problem, I particularly do not believe it should be tied into this bill where we would only further dilute the little money we have at our disposal.

Let me give one example. In the largest city that I have in my district, Federal funds were targeted to teach French on the elementary level. All of the younsters took French on the elementary level. That would have been fine, if there had been only 16 or 18 in the kindergarten class or the first grade so that they could first learn how to read English. But this money was being poured into a foreign language program for youngsters who needed all of the help they could get in remedial math and science, and in reducing the number of youngsters per class in kindergarten and first grade so that the teacher had a fighting chance to help them.

I do not think this bill is the place for any provisions for foreign language or any other subjects. There is not enough money in the bill and I do not think we have had enough hearings or enough expertise to know what to do to justify additions to the math and science aims.

Mr. GREGG. One more question. Can you tell us how you arrived at the formula? Why did you not go to just part A? Why did you not just go to per-student distribution? For example, in New Hampshire, this formula works against our State because of the fact that we do not use State funds to support our education system in the State, we use local funds by real estate taxes.

Mr. **Goodling**. It was a compromise. I do not have to tell you how formulas get written. If you're familiar with our committee, I do not have to tell you how formulas get written in our committee.

We had to have a compromise and we worked one out with Chairman Perkins and Congressman Ford and myself, and the formula you indicated was the compromise. Because of limited funds we had to do something—that was the only way we could get the formula worked out.

Mr. **Gregg**. Thank you.

The **Chairman**. Mr. Valentine.

Mr. **Valentine**. Mr. Chairman, I thank you for recognizing me and giving me this opportunity. I am, like other members of this committee, pleased that—did you call me for a question or for the——

The **Chairman**. For a question. I will call on you for the other.

Mr. **Valentine**. I do not have any questions, excuse me, sir.

The **Chairman**. Thank you, sir.

Mrs. Schneider.

Mrs. **Schneider**. Let me pick up where you left off in referring to the allocation of dollars for language purposes. I am inclined to agree with you, and I also recognize that money talks, but is it really necessary to allocate dollars for language purposes in this bill, or would it be possible to provide language to authorize appropriation dollars for the math and science, but also send a clear-cut message that languages have to be part of our priority in addressing our educational improvements?

Do you think we could accomplish the committee's intent, that way? We have had problems in listening to educators and everyone says, well, here is the shortage, here is the problem.

It seems that money is not always the solution. Perhaps we can, in this bill, send a loud signal that greater emphasis ought to be put on languages.

Mr. **Goodling**. I would agree. That is why I said that the superintendent of D.C. schools is such a breath of fresh air. Educators sometimes come forth and say that all we need is more money; that is not what we need. Money has not gotten us out of the problems that we presently have.

Yes, I think that foreign language is something that we should tackle, something that we should have hearings on, something that we should come up with a separate piece of legislation when we have an opportunity and when there is money available to fund it appropriately.

I do not believe it should be attached to this bill, other than as you are indicating—assigned. In committee we did manage to prevent insertion of the foreign language provision in A, but lost by one vote to remove it from B.

There were so many proxies that some people forgot how they were to vote which proxy, so we are hoping that we can knock it out completely on the floor rather than retain it as part of the bill.

Mrs. **Schneider**. OK. One of the things that concerns me in the administration of this bill is in reference to a comment made by Congressman Gregg a moment ago. That is that the National Science Foundation has had greater experience in providing that link of science education with the private sector.

I was just wondering, is the bill going to specify that it will be the National Science Foundation? Your response before was that, well, there needs to be a partnership between the Department of Education and the National Science Foundation.

We have seen experiences before this committee once again with partnerships between NOAA and EPA and too often when you do not have one designee be responsible for the administration of the program, you do not get the job done as effectively.

Could you elaborate a little bit on that?

Mr. GOODLING. Our thought was that the content part, the strict content part, certainly should be handled by the National Science Foundation. We think perhaps the teaching of may be construed as an educational function, and therefore something that we as a committee have a vested interest in, but again you have to understand our committee. I think we made real headway getting the National Science Foundation involved in this whole thing. The summer institute has always been handled very well by the National Science Foundation, and of course the technical material—the actual math and science—is certainly in their bailiwick.

The teaching of that material, I think, perhaps we should be handled on the education side of the partnership.

Mrs. SCHNEIDER. OK. You had also mentioned the public broadcasting. Could you expand on the role there?

Mr. GOODLING. Someone on our committee wanted to take a certain amount of this money, for instance, and use it for advertising the fact that we have a problem. But, I indicated that we have little money to start with, much less to spend on advertisement. I found out that the best way to educate the parents, is through that captive audience in front of you, the students, and they do a great job. They will do all the advertising that has to be done, but there are many public service programs that could do much to address the problem itself.

I think public service broadcasting certainly does a good job now. But if they had a greater role, a greater opportunity, they could do an even better job, not only in the area of content, but in the area of telling us what the problems are and why it is so important that we tackle them and how different life is going to be in the year 2000 than it has been in the past.

I would hope they would have an expanded role because I think they have done an exemplary job with the limited resources that they have had.

Mrs. SCHNEIDER. OK. Thank you very much.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Mrs. Schneider.

Mr. Walgren, and without objection, I understand you had a statement that will appear after Mr. Winn's.

Mr. WALGREN. If I can insert that into the record at that point, I would appreciate it, Mr. Chairman.

The CHAIRMAN. Without objection.

Mr. WALGREN. Well, I certainly want to say how much I think of the approach and the contribution that Mr. Goodling has brought to this process, not just this process, but to the education programs that he has worked on in the past.

The thing that strikes me in all this is that I wonder whether we have thought out the relationship between the Department of Education and National Science Foundation or given as much thought to it as we probably should as two committees. I realize that there is another authorization process following this for the National Science Foundational loan.

But it strikes me that in the part B that is jointly referred to both our committees, we have a number of programs in which the National Science Foundation has had a major role in the past.

I just wonder how we should balance the responsibilities between those two agencies. For example, in the summer institutes, the National Science Foundation has conducted focus summer institutes for a whole number of years and really committed more dollars in those areas that has been historically true with the Department of Education.

Can you give any guides from your point of view as to how we should try to sort out which agency does what?

Mr. GOODLING. I would first of all agree with you that we should have given more time to this marriage and how we are bringing it about, but of course, you are aware, we are all aware of how we rushed through the preparation of this legislation. I spent a Saturday and a Sunday, day and night, trying to get through the testimony because I thought we were going to mark it up the next Tuesday although we had only had the testimony the week before.

As I indicated earlier, I think we must rely on NSF in the area of the teacher institutes, in the area of actually teaching the math and the science to the teachers. I think we must rely on them for dissemination of their research and how it can be used, particularly with things changing so rapidly in these fields.

In fact, we added an amendment in markup which indicated that dissemination of whatever is learned through this whole effort, this joint effort, should certainly get back to the schools and to the people who can make a difference in training students for the rapid changes of the future.

So, I believe very strongly that there is a major role for both the NSF and the Department of Education, and again I would merely say that when you talk about technical consent that is one responsibility and when you talk about the teaching of that is another. The first can be handled by NSF, the second by the Department of Education.

Mr. WALGREN. So, it is your feeling that division should lie along the line of the National Science Foundation pursuing how the best way is to achieve a certain result with the Department of Education than delivering the program that, in fact, attempts to achieve that result.

Mr. GOODLING. Well, I think NSF has the responsibility to do the research and the development of programs. I think they have a responsibility, as I said, in the institutes, and have done a fine job. When I talk about the teaching of, the actual how-do-you-teach, I think the educators have expertise in that area.

That is why I indicated that I am concerned, and Paul and I have discussed this, I am concerned that we can do more for these people after we know that they can be good teachers. We generally learn that when they are student teaching.

Mr. WALGREN. In my own mind, I have been wondering whether it would not be wise to have the responsibility clearly divided so that one agency takes all of one effort and another agency, if it is more appropriate, takes all of the other effort. I am thinking of summer institutes at this point because it is going to be awfully difficult to carry out coordination.

It is also true that we ought to really—would it not be your view—really try to bring about an awful lot of transfer of experience between these two agencies that are active in this area?

Is there a way that you can suggest that we can work on that part of the problem?

Mr. GOODLING. Well, I think several things. First of all, knowing that agencies do sometimes operate in a vacuum, as committees in the Congress sometimes act in a vacuum, what you say makes a lot of sense. I think when we are talking about the elementary and secondary teachers, we are talking about a Department of Education function.

But when we are talking about the postgraduate level, when we are talking about those people who are going on into research, then perhaps we are talking about NSF.

Joint committee hearings probably, if we had the kind of time that we should have had to put this legislation together, would have been ideal. Of course, Paul has the luxury of serving on both committees. I do not, so I do not really know what you are up to during the year.

I do think the division that I just mentioned would be one that you could make in responsibilities carried by NSF and the Department of Education.

Mr. WALGREN. I want to then just touch on the authorization for teacher initiatives in part C of the bill where we would authorize the Department of Education to spend such sums as may be necessary for teacher initiatives. I am just wondering how—we have had programs in NSF that have touched in that area. Clearly it is a very important area.

If we get both agencies into that with such sums as may be necessary, it really seems to me it is going to come to some kind of very frustrating conflict.

Mr. GOODLING. May I say that part C was an amendment that came at the very end of our discussion. It does not take place now; it is for the second year. I would hope by the time that comes around, we would have worked out the specifics of responsibilities so that there will be overlapping and so there will be no fighting between agencies.

Part C does not take place in the first year. It is a second-year provision, and of course, eventually the Appropriations Committee is going to have to have a say in its application.

I would hope that we could iron something out before that second year so that we do not have the Appropriations Committee doing our job.

Mr. WALGREN. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Walgren.

Mr. Winn.

Mr. WINN. Thank you, Mr. Chairman. I am glad to have the opportunity to have Bill Goodling appear before the committee and answer some of the questions. I do not think there is anybody much more knowledgeable in the field of education in Congress than is our good colleague from Pennsylvania.

At the same time, I would have to admit, Bill, after the kind words that somebody said that you are usually very conservative except when it comes to education and sometimes you get into another category there, but——

Mr. GOODLING. Just putting the priorities where I think they should be.

Mr. WINN. Priorities, I understand. Now in the part A section that we are talking about in the hearing today, was that originated by NEA?

Mr. GOODLING. Part A?

Mr. WINN. Part A.

Mr. GOODLING. No, I have already told NEA, but I suppose they are represented here today so I will tell them again.

Mr. WINN. They usually are.

Mr. GOODLING. From all the testimony that we received in my committee I clipped out what I thought each witness was saying and tried to consolidate their statements because I had the feeling that most of my colleagues were not going to have time to read it. I had to admit that NEA did not have anything in their testimony that I found helpful. Basically, they merely asked us to give them more money.

I understand what they were doing—they were testifying on something that they had instituted last year and wanted to have develop into legislation, rather than testifying on what we were doing now.

I must say that I do not know that NEA had anything to do with this particular piece.

Mr. WINN. Well, that is what I wanted to help clarify because similar——

Mr. GOODLING. First of all, their bill was in the area of $2 billion.

Mr. WINN. I realize that and I wondered how much input they had in this bill.

Mr. WALGREN. I hate to say none, but I would have to say very little.

Mr. WINN. Well, I wanted to clarify that in my own mind because I had heard, and could not verify it, that they wanted to carry over their bill into 1310. There is a lot of difference between the $2 billion and the $400 million. They have a lot of other things that are not in there.

Mr. GOODLING. Yes, they have a lot in their bill. We do not have that kind of money. So see how conservative I was?

Mr. WINN. Oh, yes, I want to congratulate you on that.

Is there anyplace in this bill that, of the total between the three jurisdications, which would be around $400 million, as I understand it, that you think could be postponed or delayed without hurting the general intent of the bill?

Mr. GOODLING. Well, as I indicated earlier, and my good colleague from Illinois was not here at the particular time. My concern is that by trying to add anything else besides math and science to this bill, no matter how logically it seems to fit, you are going to stretch limited funding too far, particularly when we're talking about $300 million in the House and $200-and-some million in the Senate for our entire effort.

As the bill is written now, schools are encouraged to use part of the funding for foreign language improvement—that provision I would have delayed. Also, as I said earlier, my emphasis would have been on graduate students simply because I do not think we know whether a junior is going to be a good teacher or not. Again, I'm talking about targeting current teachers.

We probably, in this effort, should have limited our efforts to current teachers, but because everything is accomplished by compromise, we have expanded our focus.

Mr. WINN. I caught that in your answers to Mrs. Schneider when you said that the result of your being a strong believer in relying upon the private sector. But, you had to compromise and the two gentlemen that you named are not known as being some of the most conservative Members of Congress and so the compromise was about two to one, I see, by the total figures.

Mr. GOODLING. Well, you must understand that in our committee, the compromise is always two to one.

Mr. WINN. I understand that. Let me ask you, Bill, about some of the subjects that I think were discussed in your committee and have been by some of our individual members: the matching State grants with private industry, student work study programs, and student faculty loan programs. Which of those and any others that you think have great merit, particularly working with private industry. But in the long run, if they would help finance some of these programs, they could probably come out with some extremely capable employees.

Of course, that is, I suppose, based on the economy when it gets better.

Mr. GOODLING. As I indicated earlier, Mr. McCurdy, I think we have to get Ways and Means involved vis-a-vis tax credits in order to prevent math and science teachers from drifting to industry. However, tax credits alone will not do it all because there are an awful lot of headaches in the teaching business.

You also have to go the tax credit route, I think, when it comes to business sharing their personnel with education programs, and I think you have to do it when you are talking about updating equipment. There is no way that any school district, no matter how wealthy it is, can update equipment in the areas of math and science continually.

In my estimation, it is a responsibility that should be shared. Again, I would say that if you were to bring the Superintendent of the D.C. schools before your committee to testify, she will tell you how to facilitate the marriage of private sector and education programs. She has done a beautiful job thus far.

Mr. WINN. Thank you very much. I do not have another question, Mr. Chairman, but I would like to get a commitment from Mr. Goodling, if his time allows, that he might help back up Mr. McCurdy before the Ways and Means Committee.

Mr. GOODLING. I would be happy to do that.

Mr. WINN. Thank you very much.

Thank you, Mr. Chairman.

The **Chairman**. Thank you, Mr. Winn.

Mr. Glickman.

Mr. **Glickman**. No real questions. I want to welcome you to the committee. As you may know, I also served on a school board for 4 years and have some concerns about how these programs will be actually implemented in the school system.

I would only mention a couple of things. You may or may not want to comment on them. You know, I do not want to throw cold water on all of this, I will probably support the bill, but I think the real need in the future is information skills, not so much science and education.

That is, I do not think we need to be training people on how to produce computers, I think we need to be training people on how to use them. So I just get—it looks like we are back in the cycle again where we are going bananas on training people in math and science, which is fine, but if they cannot relate it to each other, it is totally useless.

I would hope that this does not become kind of a way to make us feel better when the real problems in this world are talking and writing to each other, on science or whatever we do.

The only concern I have——

Mr. **Goodling**. Before you came in, I had indicated that one of our emphases was to try to do something with those elementary teachers who have had very little training in the areas of science and math and in the relationship of those subjects to the real world we live in.

If we do not do something on the elementary level the youngster may have a great appetite for math and science when he arrives in first grade yet not receive training to satisfy the appetite until perhaps seventh, eighth, or ninth grade.

Mr. **Glickman**. I agree. I think that the real focus and emphasis ought to be on the elementary world, because I am not sure, given the way the world is changing, that we are going to change that many young folks by starting it in high school, when, in fact, we need to start it earlier.

But I am just concerned about the fact that the real world of the future is going to be relaying information to each other. We are probably going to have lots of scientists. We are going to come up with all sorts of wonderful ideas and I am concerned that this bill may kind of make us again feel better about taking care of our math and science needs because everybody else in the world is doing it or we have some statistics that show that we have a lot of teachers out there that are not capable of teaching it.

Again, I do not want to get us to lose sight of the real problem here.

Mr. **Goodling**. Well, again, before you came in, I indicated that I hope our whole emphasis would not be on making the elite more elite, but to do something about the 90 or 95 percent out there who are illiterate in the areas of which we are speaking.

Mr. **Glickman**. The other concern I have is some concerns that teachers have related to me that, you know, the idea is, I suppose, to get teachers better educated in some of these areas so that they stay in teaching and not so they move right out into industry and make three and four times the money they are making now.

Again, I hope that the kind of training that we are talking about, in-service training, is geared toward retaining those folks in the educational arena and not moving into the industrial sector.

Mr. GOODLING. I think we will need the tax credit that I talked about, also, to help keep them there.

Mr. GLICKMAN. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Glickman.

Mr. Lewis.

Mr. MacKay.

Mr. MACKAY. Thank you, Mr. Chairman. I have a couple of questions that are not designed to be editorial, but I am just trying to seek some information.

The first draft of the bill said 5 percent would be set aside for State departments of education. The final draft appears to say 25 percent.

Mr. GOODLING. We had a real drafting problem. The way the bill was originally written, we were really reserving so little for administrative costs that there was no way any State could administer anything, so we had to rework that whole section.

But we are not talking about giving more money for State administration but rather we are talking about creating a major programatic role for the States. I must admit that under the original draft of H.R. 30, I questioned whether 5 percent was not too much for pure administrative funds when, in fact, the States had not direct programatic responsibilities.

Mr. MACKAY. I would like you to know that I do not consider myself literate in math and science, but I have trouble with the idea that 25 is less than 5.

Mr. GOODLING. Now, you are talking about a different area. Let me reemphasize. I was talking about the fact that we have administrative expenses listed, and the way we had it listed was an error. We had to rewrite that section. I think you are talking about the bonus to local school districts for innovative programs. That is the difference between 5 percent for State administration and 25 percent for State operated programs.

A lot of us felt that there had to be an incentive bonus tied in there so that we just did not do "more of the same." "More of the same" has not been good enough, so we tied that 25 percent in as an incentive bonus to do the things that, again, I hate to keep referring to the Superintendent of the D.C. schools, but the kind of things that she and others have been doing in which they involve the private sector in the classroom. We want to encourage schools to doing something different, worthwhile, and that can be shared with other school districts.

Mr. MACKAY. I would be interested in the comments from persons in education at the State and local level as we go along, but my impression is that innovation is more likely to be brought about in my State, the State of Florida, by money given to the local districts, than by money given to the State Department of Education. It seems to me that you went backwards when you made that change.

Mr. GOODLING. This money is for discretionary grants to the local school districts that are involved in innovative programs. This is what we are doing. What you say we are doing goes through State hands, but, under the incentive bonus portion, they can only give it to the local school districts who are showing some innovative programs.

Mr. MacKay. All right. One other question which is in the nature of the same trying to get information. I noticed that the initial bill allowed local education agencies to, it seems to me, to have more flexibility in inservice education than the final draft did. The final draft, for instances, says they can pay expenses of teachers going to State-operated inservice education programs.

Now, in the State of Florida, the primary model by legislative initiative has become teacher centers which are not State-operated, and I wondered if you meant to write them out.

Mr. Goodling. No. As a matter of fact, we are encouraging the local districts to set up these institutes, the in-service programs. Particularly in some areas where there is very little population, you may want to combine with other districts or you may want to run such programs through the local college or community college, whatever it may be, because you may not have money or enough people to make it worthwhile to do as an individual school.

But the encouragement is for educators to do it locally, as far as inservice programs are concerned

Mr. MacKay. Well, I must be reading into that, then, something which was not intended. It would seem to me you could say State-approved or operated, and you would eliminate what is going to be the source of, it seems to me, some major friction.

Mr. Goodling. This area provided a real battle in committee because, of course, everybody who testifies from the education field thinks differently. The State board says do not give it to the State director; the State director said do not give it to the State board, the school board says, do not give it to the State, and the local teachers say, do not give it to the school board. It presents a real problem, but I think that we have written into the bill the idea that the initiative should be local as far as inservice is concerned, but help is available if they want to join together several school districts, and if they want to tie in the local school, the local college.

Mr. MacKay. Thank you.

The Chairman. Thank you, Mr. MacKay.

Mr. Bateman.

Mr. Bateman. Mr. Chairman, I wonder if at the outset if I could raise a procedural question and if the Chair could help me with it.

The Chairman. Yes, sir.

Mr. Bateman. There are two aspects of the bill that have been discussed before this committee that give me some pause. One is the inclusion of the foreign language component of the bill. The second has been touched upon only very briefly, and that is, the formula for the allocation of funds among the States.

In each instance, it is my impression that the results which we see reflected in the draft of the bill before us were a part of some compromise within the Education and Labor Committee. Having served in the legislature at a different level for 15 years, I understand the necessity of that happening.

But it brings me to a question of, is the compromise in that other committee where we jointly share jurisdiction binding on this committee under the rules and precedents of the House, or is this a matter for further inquiry and productive discussion by this committee?

The **Chairman**. Let me say to the gentleman that title I, part B is jointly referred. There are some parts of that that relate to the Education and Labor Committee, other parts relate to this committee. If it is within that part of the bill, certainly it is open for discussion and we can discuss it.

The gentleman is perfectly within his rights, as well as title II, which is solely within this committee.

Mr. **Goodling**. May I merely respond to that by saying that the formula that I talked about in the compromises is strictly in part A of title I, which is, as I understand, under our jurisdiction. It is not in any other title.

Mr. **Bateman**. It is early in my tenure here to be seeking contention between the two committees in jurisdictional disputes, but I remain somewhat in doubt. I do not want to waste the committee's time by inquiring into the inclusion of foreign language, and I believe it is title I, which I think, as much as that subject matter is important, is misplaced in this bill.

Nor do I want to get into some contention about a formula if it is not our business in this committee to get involved in it. That would be something to be dealt with elsewhere. I would certainly want a further explanation of this formula and how it impacts upon the State that I am most particularly concerned with before I let the opportunity go to question it.

Mr. Chairman, if I am not within the purview for the jurisdiction of the committee, why, I will——

Mr. **Gregg**. If the gentleman will yield.

Mr. **Bateman**. I yield.

Mr. **Gregg**. I believe that this committee does have jurisdiction over the foreign language section, because that is in part B, or at least we feel we have jurisdiction over that, but that part A language of the formula is outside our jurisdiction and would have to be taken up on the floor. Is that correct?

The **Chairman**. It depends on whether it is funded through the Department of Education or the National Science Foundation. If it is the National Science Foundation, it is within this committee; if it is the Department of Education, it is within the Committee on Education and Labor.

Mr. **Gregg**. Well, this is an important point then, Mr. Chairman. Are we going to be able to address the amendment of the language on foreign language in this committee?

The **Chairman**. Well, the Chair will have to rule when he sees an amendment. But I have generally outlined, if it involves the Department of Education, that would be within the jurisidiction of the Committee on Education and Labor.

If it involves the National Science Foundation, it would be within this committee. Now, that does not mean that we cannot work with the committee to satisfy some concerns that we have, even though it may be in their jurisdiction, and likewise, them with this committee.

We can negotiate something when we get ready to go to the Rules Committee, should that be the wisdom of the committee.

Mr. **Bateman**. Fine. I thank my chairman. I will abide at some future opportunity to address those concerns, but I do have a more general question I would like to ask of Mr. Goodling.

You made reference to discussions that you had participated in with the NEA with regard to the general proposition of merit increases for educators who were demonstrating a superior competence and dedication to their responsibilities, as opposed to what has become, perhaps, a norm of general across-the-board increases.

I wonder if you could share whether or not you felt that you made any dent in what has generally been the association's institutionalized response to those concerns that many of us have shared?

Mr. **Goodling**. Well, as I have indicated, I was directly involved in public education for 23 years; and I know how it operates and how it works. I believe that the NEA, AFT, PSEA, whoever it may be, Virginia Education Association, all have a responsibility to work with school boards to reward those dedicated teachers who do an outstanding job. I also know it is very difficult to get rid of, as we would say in Pennsylvania, inadequate teachers.

May I just say one thing; 50 percent of the money allocated in the bill favors the poor States, and 50 percent of the money rewards States making a better-than-average contribution in education. That was a real compromise because over the years we basically have been rewarding States who have done the least on their own in the area of education. So it was quite a compromise.

Mr. **Bateman**. Thank you very much.

The **Chairman**. Thank you, Mr. Bateman.

Mr. Reid.

Mr. **Reid**. I have no questions, Mr. Chairman.

The **Chairman**. Thank you, you are helpful.

Mr. McCandless.

Mr. **McCandless**. Thank you, Mr. Chairman, you do not get off that easy with me. [Laughter.]

I have not had the pleasure of meeting Mr. Goodling, it is nice to have you here and visit with you on a subject that is near and dear to my heart as a former county supervisor who employed 7,000 people with varying degrees of education, and a former businessman who used to take in people at the entry level with a great deal of trepidation based upon what they lacked in the way of skills.

In your prepared comments, you mentioned the fact that some 640,000 children who wanted to take math and science were required, instead, to take courses in other subjects for which no teacher shortage existed.

I wonder if the subject might go a little deeper than that and that is why I wanted to ask you this question. There seems to be a general trend on the part of school districts to find, and this might not be the correct word, the easiest way by which to matriculate that individual through the process, giving he or she the diploma that the school district is required to because of the pressures that the school districts are currently in, both in terms of qualified teachers, in terms of money, and other things.

We talk about math and science and I think we could all agree that anyone who is interested in math and science requires more discipline on the part of the students, more devotion than, say, social studies or vocational education in comparison.

In doing so, we examine what we might call the growth of the seed of education in that individual, which would germinate if he or she were to have the basic tools by which to function, the reading skills, the comprehensive ability, there would be more inducement on the part of more students to want to get into these fields.

If we examine, then, the current situation, we find the lack of that which then that seed would not germinate into the leaves and the branches of the tree that we are seeking. So are we again trying in a shotgun approach to cure a problem in a specific area that has actually more depth in the basic structure of our educational system as we now understand it?

Mr. GOODLING. Well, as I indicated, we want to put a great deal of emphasis on the elementary level, an area which has been forgotten most of the time. I think if you are going to provide any fertilizer to that seed you mentioned so that it grows, it is going to have to be fertilized much earlier than we have been doing up until now.

That is why I also said that if you have money, you should not send it to a center city school to teach foreign language when you could reduce that kindergarten and first grade workload to give them a fighting chance to learn more basic skills like reading.

We started out this bill with a shotgun approach, I think, but what we have tried to do was narrow it down, focus on just a few areas to make the best use of the money we have.

Mr. MCCANDLESS. I am not certain how many school districts are in the United States, but there are quite a number in the State of California. We talk about the availability of the amount of money which is in this bill which may or may not result in being that amount if it is to pass through the process.

I equate that kind of money to the State of California and say there are certainly equally urbanized areas. It would appear to me that that would be an amount that would not find its way very far in the process of the intent of the bill.

Mr. GOODLING. Well, there are 16,000 school districts in the country. However, we do, in our formula, heavily rely on chapter I, which would certainly help those districts to which you just referred.

Mr. MCCANDLESS. Has the thought been given to a school district at the local level applying for these moneys with a specific outline of a program on how they might desire to proceed and accomplish the objective, rather than the trickle-down effect of the superintendent of schools at the State level, et cetera, et cetera, et cetera?

Mr. GOODLING. That is the incentive bonus that we talked about—the 25 percent incentive bonus—to get the local agencies to come up with innovative ways of approaching the subject. We are trying to reward those who, in fact, on the local level, do just that.

Mr. MCCANDLESS. I think the intent of your objective is commendable. Mr. Goodling. I hope that it does accomplish the objectives. Thank you.

Mr. GOODLING. We will know in 10 years.

Mr. MCCANDLESS. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. McCandless.

Mr. McCurdy.

Mr. MCCURDY. Thank you, Mr. Chairman.

Bill, it is a pleasure to see you on this side of the table for a change. I have been before your committee a couple of times and I always appreciated the respect over there and the work that you are doing. I understand some of your frustrations, perhaps, as far as getting legislation through, and perhaps even with this bill.

I think, if you were not present the other day, we had a very interesting session from my perspective and I think we accomplished some things, though. I think there is better communication now than there was a couple of weeks ago.

Mr. GOODLING. Much better. I think the leadership at the top level may have had something to do with that.

Mr. McCURDY. I think it has been very helpful. I commend our chairman and you and other individuals for wanting to work together, and Mr. Simon on this committee, who also serves on your committee, has been very helpful.

We have had a number of meetings with the minority on my side, but also Mr. Simon and people on your committee, and feel that we are making some progress.

I might just take a moment to enlighten you. I think those people are interested. Some of the areas that maybe we have been moving, and you might be able to provide some insight from your perspective, I, too, have had some difficulty with the foreign language section, or the requirement within the bill.

Since you and I both serve on the Intelligence Committee, I would comment that I have requested from them an unclassified statement as to whether or not there is some reference or some guide as to what languages there may be critical shortages in, if there are, from a national security standpoint, from an economic standpoint, because I would venture to guess that there is not a shortage of French and Spanish teachers, but there probably is in Japanese, Russian, and some of the Third World languages that there may actually be a critical shortage in.

Perhaps, as a compromise measure, if that provision is not stricken, then as a means to have some classification or designation of what languages are indeed critical, and whether something can be done to address that need, as opposed to again throwing out a bunch of dollars at an unspecified problem.

I think Mr. Simon has been interested in that approach, and I think there is possibilities of some movement in that area, but again, I offer that more for information.

I have been concerned, I think, as a number of people have, about the lack of specificity in some of the provisions of the bill, and by design, I understand that some are. I understand your experience and background, but I was an attorney for a couple of school boards and my experience has been that two adjoining school districts are night and day, that one, a very rural school district that I represented, was very, very backward, and one was the most modern, up-to-date, innovative school districts in the country.

There is still a distribution problem, and I am not sure that the Federal Government does not have a role. I think the Federal Government does have a role because there remains to be a distribution problem in the quality of education.

I enlist your support and ask for your support on my bill in Ways and Means for the private-sector involvement, but to be honest, we have problems. I have asked for a revenue analysis, or an analysis on the revenue loss from the committee. It is going to be difficult to obtain the commitment of the leadership on both sides of the aisle of that committee for another bill talking about tax credits because of the deficits and the loss of revenue that we are experiencing now.

I think we are going to have a difficult time and just to say from the outset, well, that is our solution to the problem, we cannot bank on that. I think we must move in this bill.

On the next provision as far as whether or not we have scholarships or loans, I think we have solved that linguistic problem. They are loans. I think we are going to call them loans. I think we have reached an agreement there.

There is some question as to what year they start. I would tend to disagree with you and I would like to have your comments. I think we need to hit these people when they declare majors. In other words, I want math and science majors going into education. I do not want math and science education majors going into teaching. Maybe that is a distinction some people do not understand, but I think we need those people that are math majors and graduates in mathematics and science to be teaching, as opposed to a general person who says, I am a teacher, my area of expertise happens to be math or science. There is a critical distinction there.

I think we worked out that problem in the bill.

Mr. GOODLING. I think the President's approach was dealt with in their piece of legislation.

Mr. McCURDY. Right. Well, I think we worked it out in this bill, too, so I am just saying——

Mr. GOODLING. But the best math and science students, as I indicated, sometimes are very poor teachers.

Mr. McCURDY. Right. I do not think there is any question. Some of these people we are trying to attract out of the private sector may be bad teachers, but they have an experience that perhaps they can relate.

Communication is a difficult problem, but again, I think the depth of knowledge, if you do not have the knowledge to communicate, then you are not going to be able to get it across or understand.

I would agree with you as far as the public television's role. I think we had a seminar on math and science education problems in my district in Oklahoma, and Mr. James Crimeans, who wrote the film, produced the film, "Search for Solutions," made a presentation and his involvement in kind of lighting the fire in students from a visual standpoint has been very good.

I understand Phillips Petroleum and a number of private companies have provided some grants for him to produce films in math, "Search for Solutions" in relation to math. Some of those questions.

So I think there is a role there that certainly can be played. I would support any agreement or compromise whereby we could have a greater participation. Maybe that is just specific language in the bill, without dollars and figures.

Mr. GOODLING. You mentioned communication and I think you have to be very careful when you talk about the brilliant math and science individual who was trained to be brilliant in math and science but gave no thought to the business of teaching.

I had a geometry teacher one time in college who said I had a snowball's chance in Hades of passing his course if I did not get on the ball. I would have felt badly if I had been the only one in the class who did not understand what he was teaching, but the entire class did not.

Thank goodness he is now in the private sector doing an outstanding job. That is where he belonged. He could not communicate the knowledge that he had stored.

Mr. McCurdy. Mr. Chairman, one last point.

I think one of the things that we are wanting to place in the bill as perhaps language, and there is difficulty because I do not want to invade the State's province in this area, but I think the State superintendents and the State administrators need to look very closely, and the State legislators, at the requirements for certification of teachers.

In some areas, such as math and science, because of the critical nature of the shortage, in order to allow people from the private sector to teach a skill, that perhaps there needs to be some relaxation there or an emergency provision or some bailout provision or something to allow them to draw upon some of those skilled people.

Mr. Goodling. We made sure that we knocked down an amendment in committee that we thought was going to do just the opposite. It was well intended but it appeared that it would mean that someone from the outside could not come in and spend 2 weeks or 3 weeks teaching math or science because of the certification problem.

Mr. McCurdy. Again, I think Mr. Walgren is working very closely, and I know the chairman of this committee is, to put a higher degree of specificity as to the programs that NSF would administer, as opposed to the Department of Education, and again trying to line up the guidelines there in order to clarify any vagueness or uncertainty as to what role each would place.

Again, I just enlist your support and appreciate your involvement and offer a hand of cooperation here to work with you on this bill.

Thank you.

The Chairman. The time of the gentleman is about to expire. [Laughter.]

Mr. Walker.

Mr. Walker. Thank you, Mr. Chairman. I would like to join you in welcoming my neighbor from Pennsylvania to the committee and thank him for his testimony here this morning.

As I listen to the testimony before the committee and look at the testimony we are about to receive, and look at the bill, one of the fears that I have is that this is another one of those bills that is for exemplary purposes, but for that reason, tries to become all things for all people.

I appreciate your testimony that you tried to reject the scattergun approach and went for some specificity in the bill. I think that is necessary and if I read your testimony correctly, Bill, it appears to me that one of the major things that has to be done in this field is to create some jobs.

From the testimony that you presented to us, based upon what the National Science Teachers Association told your committee and so on, it appears as though even in this recessionary climate, there are some real job opportunities out there in this field if we go after them.

If I divide out 32,000 classes in math and science that were needed by, say, 6 classes a day for teachers, which is a fairly heavy load in the schools right now, that is 5,000 teachers.

If we put one physics teacher in the school districts that do not even have one, that is 6,000 teachers that we need. If you divide out the number of students who wanted to take math and science, but could not, by putting 40 kids in a class, which is a fairly large class load, it comes out to 16,000 teachers that we need out there.

I guess my question is, How far does this $400 million that we are going to spend go toward creating the 20,000 jobs that apparently are needed in this field?

Mr. **Goodling**. We think it could go a long way through the inservice programs and the summer institutes. For instance, I talked earlier about those teachers who may not have the proper certification for math and science. They may be very close, but they don't have the proper certification. They may be general science and need something else in physics or chemistry and so on. We think the summer institutes and the inservice programs could go a long way in alleviating that shortage, keeping in mind that in some districts, as was mentioned over here, they don't have any shortage, and in the next district they have a sizable shortage.

Mr. **Walker**. With the limited money that is in the bill, shouldn't the main emphasis be on creating those 20,000 jobs?

Mr. **Goodling**. We think that the bill does just that, as I said, through the inservice and the summer institutes. You cannot spend a long time trying to gear up for this kind of effort, so we have to rely to a great extent on those teachers who are close to certification. We have to rely on those who may be out in the private sector but whom we might be able to lure back. Also we have to put some emphasis on trying to lure new blood into the teaching profession.

Mr. **Walker**. So, in other words, from your perspective, as one of the original authors of the bill, the intention of the bill is to go in the direction of addressing the job shortages in this field, and if we are up against limited resources we ought to eliminate some of the superfluous items that get us away from that particular need. You would agree that that is the major need that should be addressed?

Mr. **Goodling**. I would agree that there are two major thrusts of this effort, as far as I'm concerned. One is filling the jobs that you speak of, and the other is doing something about the general illiteracy in the United States in relationship to math and science.

Mr. **Walker**. And the fact is that with $400 million, if we use the shorthand that we have around here for figuring out how many jobs per billion we create—we are pretty good at that around here right now—that $400 million should just about cover the need to create 20,000 jobs. If my shorthand is correct, we have used $1 billion for 200,000 jobs on some occasions around here, and we are now saying $4 billion is going to create 300,000 jobs in the jobs bill that evidently the White House is going to come up with, so $400 million by that shorthand certainly comes out to 25,000 to 50,000 jobs which are potentials.

In other words, this amount of money, even though it is more than the President wanted in his approach, this amount of money would just about address the problem if we do it right; is that not correct?

Mr. GOODLING. We think the $300 million will. You know, your committee has a different approach—deals with a different set of problems, but the $300 million that my committee has allocated for our portion of the bill will do what you are saying must be done.

Mr. WALKER. OK. In other words, our committee in its deliberations should make certain that our $100 million adds to the direction you're going; we're going to get our money out to universities, to research work, a lot of that sort of thing, but we ought to be moving in the direction of filling the job shortages there as well; is that correct?

Mr. GOODLING. The summer institutes would be under shared jurisdiction, we believe, in many instances, and we think that approach will be very effective in solving the shortage problem.

Mr. WALKER. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Walker.

Mr. Simon.

Mr. SIMON. Thank you, Mr. Chairman.

First of all, as a freshman member of this committee, I welcome Bill Goodling to this committee.

Let me just say to my colleagues, this bill, whatever its defects, is a much better bill because Bill Goodling was willing to really dig in and do some work. I appreciate that.

On the comments of my colleague from Kansas, Mr. Glickman, I think he should know that originally this bill had more of a secondary school emphasis. For example, the president of the math association came in and testified "If I were to choose, I would choose elementary schools as the area where we need the greater emphasis." So this has changed. The summer institutes presumably are going to be—and I hope our report language makes that clear—that it is not just going to be for high schoolteachers but it is going to be for elementary schoolteachers. I hope we have moved toward some balance here.

Let me, with all due respects to my colleague and a couple of others who have commented here, on the foreign language aspect, let me just point out a couple of things to this committee.

Congress is great on solving yesterday's problems. We are fair on solving today's problems. We are very weak on solving tomorrow's problems. And where we are today is a situation in technology transfer, where our friends in Japan, who can read English, they are able to get our technology; our friends in Germany and France who can read English get our technology. Our ability to get the technology of other countries is shockingly weak, and an increasing percentage—in fact, it is a very escalating figure, rapidly escalating figure—an increasing percentage of the world's technical journals are printed in other languages, not in English.

Now, we can pretend that isn't the case. But we are simply fooling ourselves about where we are today and what the needs are going to be tomorrow. I think we ought to face up to that reality.

Let me point out, second, if the only foreign language aspect is part B, if at the most 10 percent of the funding goes for foreign languages—and I don't think anybody thinks it is probably going to be that high—you're talking about $5 million out of a $400 million bill. I think that is woefully inadequate myself. But if anybody wants to eliminate it, I can assure them that at least I'm going to provide some fight on that point.

Finally—and this is a question, and I just toss this out; I am not advocating this—someone this morning said to me, if we want to really move things rapidly, we ought to, for fiscal year 1983, just take $2 million of the $400 million total, put $1 million in NSF, where they can move on some grants right now that are pending, and the FIPSE, the fund for improvement of postsecondary education, where they have a number of science and math grants, where they could move very rapidly. Again, I am not necessarily advocating it. It is a suggestion that was made to me this morning, that I have to say, off the top of my head, makes a little bit of sense. So I simply toss that out. You may want to respond or react to that suggestion.

Mr. GOODLING. I don't know the technical answer to that. Can you do that?

Mr. SIMON. The answer is we can do it. Obviously, it would take a supplemental appropriation, but there will be supplemental appropriations coming down the pike.

Mr. GOODLING. In that case, if we can get some of the groundwork done in advance by doing that, I think it would be a worthwhile expenditure.

Mr. SIMON. I think—and I would pass this along to the staff—I think it might be worth doing some checking on.

Again, Mr. Chairman, I simply want to say that Bill Goodling has made a substantial contribution in this area and I hope the Members of the House appreciate that contribution. I do.

Mr. GOODLING. I appreciate that.

The CHAIRMAN. Thank you.

Mr. Boehlert.

Mr. BOEHLERT. No questions, Mr. Chairman.

The CHAIRMAN. Mr. Durbin.

Mr. DURBIN. It's nice to meet you, Congressman. I don't believe we have had the pleasure before.

I was interested in one aspect of your testimony, and I have one question. That relates to your indication that there was a shortage in terms of the number of classes made available in science and mathematics in 1982, 1983, for lack of teachers.

I have often wondered, when it comes to foreign language and science, if there are any statistics available to indicate the number of students who are seeking to enter classes on science and math today as opposed to years gone by, let's say 10 years ago. Do you have any thoughts or indications on that?

Mr. GOODLING. Those statistics came from the National Teachers of Science Association—yes, they have all those kinds of statistics available.

I think we get confused. We say they are not doing things today as well as they once did, et cetera. When I went to school, of course, if you got beyond the eighth grade, that was miraculous, coming from the country. If you passed the eighth grade exam perhaps you went on.

Now we have a commitment in this country, which developed while I was an educator—you will educate the masses; you will educate everyone. It is a totally different picture. I think sometimes we fail to take that into consideration.

I think we have just as many who are seeking math and science now when you look back to compare who those students were that went on to secondary school a generation ago. But our concern now is that there are a lot who would like to take some of those courses that cannot take them, simply because there is no one certified to teach in those areas.

Mr. **Durbin**. I suppose my question is directed toward this: We are talking in this bill, and I support it, the concept of increasing the supply of math, science and foreign language teachers. But what I'm worried about is whether there will be a demand commensurate with the increase in supply.

As we indicated before, in years gone by, through parental pressure, peer pressure, the need to get into college, a lot of students like myself were in a track that included science and math. And even though we may have struggled along in those subjects, we knew it was a requirement. My sense today, in talking to superintendents of schools in central Illinois and western Illinois is that they have taken the course of least resistence and offered a student so many alternatives to science, math, and foreign language that the student takes the easier course and finds that the college no longer requires of that student the kind of background in science and math for admission, even to a liberal arts curriculum.

Mr. **Goodling**. In education, if you wait long enough, everything comes back to where it started. We went through the sixties where we had to offer all of these great courses to fully develop the youngster, so they said. Well, that didn't leave much time to do anything else in terms of basic education.

But we are trying also in this bill to emphasize the elementary levels, so that a young person, develops an enthusiasm for math and science, early on which we then channel up the line. I think that is very important.

Mr. **Durbin**. Do you see any need, though, in terms of the collegiate level, to have another commitment, if you will——

Mr. **Goodling**. That's changing, also.

Mr. **Durbin**. Is it changing?

Mr. **Goodling**. You see, as I said, if you wait long enough. Now those colleges who did away with foreign languages as a part of their entrance requirements are coming back to that.

Someone mentioned the other day that you shouldn't be able to get Ph.D's without a foreign language. A few schools came into being where that was allowed, but I don't think there are very many of those. At least, I would hope not.

But I think, again, the pendulum swings, and the masses apparently wanted it the other way because that's the way we went. Then with all the extracurriculars we added to their schedule—you know, how do you do everything? I watch my own children and I wonder how they survive.

Mr. **Durbin**. Thanks a lot.

The **Chairman**. Thank you, Mr. Durbin.

The pride of St. John's, Mr. McGrath.

Mr. **McGrath**. Thank you, Mr. Chairman. In the hope of "starting a roll," I have no questions. [Laughter.]

The **Chairman**. Thank you.

Mr. Volkmer.

Mr. **Volkmer**. No questions.

The **Chairman**. Thank you, sir.

Mr. Skeen.

Mr. **Skeen**. No questions.

The **Chairman**. Mr. Mineta.

Mr. **Mineta**. No questions, other than to congratulate our good colleague from Pennsylvania for the leadership he has shown, Mr. Chairman.

Thank you very much, Bill.

The **Chairman**. Thank you very much.

I believe Mrs. Schneider had a quick question.

Mrs. **Schneider**. A very short one.

I am concerned in part B, title I, about the inclusion, and I want to make sure that in the final form there is some inclusion of some reference to either women and minorities, or those entities that are often underrepresented, not only in terms of educational opportunities but, as we were talking earlier, about jobs. There is something there that is rather vague.

It says "The committee shall insure that the individual so selected include individuals who are unrepresented or underrepresented in the respective disciplines."

Mr. **Goodling**. We specifically zeroed in on this in part A, as you probably noticed, and hopefully we can make that language less vague because the talk in committee was, of course, that part of our shortage problem stems from the fact that women and minorities have never really fully participated in math and science programs.

I had a chemistry teacher who at one time floored me, the first year as a principal, when he said "she was a good chemistry student—for a woman." Prior to that he hadn't had women in his chemistry classes.

Mrs. **Schneider**. We run into that all too often, I'm afraid.

Mr. **Goodling**. But we hope that we're taking care of that.

Mrs. **Schneider**. OK. Well, I can assume, then—I have your guarantee that you are going to be thinking of us?

Mr. **Goodling**. We will emphasize that in part B as we have in part A.

Mrs. **Schneider**. Terrific. Thank you.

Thank you, Mr. Chairman.

Mr. **Goodling**. May I just make one final statement to Mr. MacKay? I want you to know that behind me, to my right, is Craig Phillips, who is the chief State school officer of North Carolina. I want you to know that they are a model for the kind of programs we are talking about. So if we gear up, in many States, to the level of what they are doing in North Carolina, we will be doing a much better job.

The **Chairman**. Bill, thank you very much for being here this morning. We appreciate the fine work you have done on behalf of this bill and many other matters relating to education. We know that your talents and work in the Education and Labor Committee contributed greatly to this bill being where it is today, and we thank you very much for being here.

Mr. GOODLING. Thank you, Mr. Chairman.

The CHAIRMAN. Our next panel of witnesses, first of all, is the Honorable Jon Mills, who is a member of the Florida Legislature, chairman of the education committee in the house of representatives and one of the leaders. Unfortunately, he is no longer a constituent of mine, but resides in the district that Buddy MacKay ably represents now. Jon, we are very happy to have you join us.

We will also introduce the other members of the panel, and I will call on our colleague from North Carolina, Mr. Valentine, to introduce Dr. Phillips.

Mr. VALENTINE. Thank you very much, Mr. Chairman.

I am, like other members of this committee, pleased that a full day's hearing has been scheduled on the emergency mathematics and science improvement bill. During the hearing last week, a number of members of this committee, including myself, expressed concern about the quality of our educational system and the inability of that system to attract and retain qualified math and science teaching personnel.

This bill, as I understand it, is aimed at improving the science and math skills of our teachers and students enrolled in the public educational system. Also during that hearing, Mr. Chairman, there was mention of the North Carolina School of Science and Mathematics which has achieved national recognition as a model school for gifted and talented math and science students and teachers.

On Monday I toured the school, which is located in my district, to get firsthand knowledge of the school and its programs. I have placed at each member's chair a packet of information from the North Carolina School of Mathematics and Science.

In June 1978, at the request of Gov. James Hunt, the general assembly established the North Carolina School, which has had quite an impact on our State and I believe, on the Nation. Today we have the pleasure of hearing from a good friend of mine, Dr. Craig Phillips, who is a North Carolina Superintendent of Public Instruction and a member of the board of directors of the North Carolina School. Dr. Phillips will tell us about the school and other educational initiatives in the State of North Carolina.

Dr. Phillips was asked to appear before the committee in lieu of Dr. James Elba, the director of the school, and Dr. Elba will submit a written statement for the record later this week, with the Chair's permission.

I take this opportunity to thank Dr. Phillips for coming here today to share his experiences with us on the given subject matter. I also want to thank the chairman for his cooperation in extending such a gracious invitation to Dr. Phillips.

Dr. Phillips, I want to say to you it is a personal pleasure to have this opportunity to introduce you to this committee. Good luck to you.

Thank you, Mr. Chairman.

The CHAIRMAN. Dr. Phillips, we are happy to have you.

Our third member of the panel is Dr. Joe Pettit, who is the president of the Georgia Institute of Technology. Unfortunately, we don't have any Georgians here to present you. We are very pleased that our new director of our committee staff, Dr. Poore, just left Georgia Tech to assume his position here with the committee. We appreciate you in being gracious and letting him take a leave to accomplish that. We are very pleased to have you, Dr. Pettit.

Jon, we are pleased to have you here and hear your testimony on behalf of what is happening in the legislative fields and some of the things we should be aware of in legislation of this type.

STATEMENTS OF HON. JON L. MILLS, STATE REPRESENTATIVE, STATE OF FLORIDA; DR. CRAIG PHILLIPS, SUPERINTENDENT OF PUBLIC INSTRUCTION, STATE OF NORTH CAROLINA; AND DR. JOSEPH PETTIT, PRESIDENT, GEORGIA INSTITUTE OF TECHNOLOGY

Mr. Mills. It is a pleasure to be in front of this particular committee where the chairman has been a friend of mine for a long time, and as a former constituent and campaign worker for Congressman Fuqua, it is a pleasure to be here. This committee also seems to be heavily assisted by other Floridians. Mr. MacKay, who is now my Congressman, and a friend for a long time, whom I think Congressmen in the city of Washington will come to enjoy and know, and as one of the greater leaders in education in our State, we are very gratified to have Mr. MacKay here representing us.

Then Mr. Lewis on the other side of the aisle, with whom I introduced some legislation in the Florida Legislature. We managed to fool people as to which party we were in from time to time and it is great to see Mr. Lewis here.

In addition, Bill Nelson is on your committee. So you are well taken care of by graduates of our legislature and it is a pleasure to be able to testify in front of that kind of committee.

The task force that I chaired for the past 6 months, the Speaker's Task Force on Math, Science, and Computer Education, had as its goal to assess the need for our State developing new legislation dealing with those issues, funding, et cetera. I won't, having been the chairman of a committee myself, read any testimony to you, but will just summarize what we are trying to do in that task force, and if there are any responses——

The Chairman. Jon, if you have prepared testimony, we can make it part of the record, and then if you want to summarize. Without objection, we will make it a part of the record.

Mr. Mills. Thank you.

That task force consisted of individuals from the private and public sector, including the chancellor of the university system, people from NASA, the Harris Corp., the FEA—I think Miss Burkholtz happens to be here today—and we had a very eclectic review of the issues involved with math, science, and computer education. The proposals which I will discuss have not yet been finally approved by that task force. They have not been introduced in the legislative process, and as the evolution of 1310 indicates, it is difficult to determine exactly what the final product will be.

But I would like to go over a few of these suggestions and say that this kind of hearing and the involvement with the Federal Government and the Congress provides us with an opportunity to have some context for what we are trying to do. The whole math, science, computer education area seems to have turned out to be an opportunity to fundamentally reassess what we are doing in education. It is a very basic issue in dealing with society and in our dealing with the educational system.

Generally, it seems that what we are talking about in math, science, and computer education is how the educational system teaches the skills that the society needs, for the benefit of society, and the skills that an individual needs in order to be a member of society. The dichotomy I think was identified earlier. The computer aspect of this may ultimately be as important as the math and science aspect. We understand the need to deal with a high tech society. I think I saw a commercial with a small child sitting in an F-16, the concept obviously being if you don't have someone who knows how to fly those things, you can build the most sophisticated technology in the world and still be at a tremendous disadvantage. Leaning how to play Pac Man, is not enough to fly an F-16, and Pac Man is probably the best example of our computer training at the moment.

Specifically in terms of the society that we are dealing with, a third-wave information society, the ability to communicate with computers is totally fundamental and the inability will be equivalent to total illiteracy, which, of course, scares me to death since the education in computers was not something that was fundamental when I went to school. I bought a personal computer and I have taught it to swear and a few other useful things, but education in a computer sense is a very complex thing and I hope what we develop is the ability to impart that information when students are flexible and when they can learn it.

Mr. Glickman mentioned something which I thought was important, that the computer as a tool and as a communicator was fundamental and that we needed to emphasize that. I think what we are trying to do at our State level is the same, so there are some similarities between Kansas and Florida. I will try to identify others later. They don't come immediately to mind.

The NSF generally, in the role this committee deals with, are concerned with the issues of how to teach, which is a major question, how students learn and why. There is a fear of learning science and a fear of learning math. I can relate direct experiences on that. I can tell you I wasn't asked to chair the task force for any particular background in math and science. I think attorneys are not supposed to love math, and I certainly share that general emotion.

Again, using the computer as a tool in the process of learning math and science is important.

I will just run through very quickly the specific proposals that we are likely to get out of our task force and what we hope to provide to the Legislature.

The creation of a math, science, and computer education quality improvement fund, which relates both to the hiring of additional teachers and the support personnel in specific critical areas. This, of course, I think can be related basically to title 1 of your bill.

Second, we are concerned about creating regional centers of excellence in math, science, and computer education whose goal will include but not be limited to creating an environment in which schools can provide a resource for students that would emphasize the inclusion of civic organizations, the private sector, et cetera. This, I think, may relate specifically to some of the elements in Title 2, section 4(c), where you are identifying the importance of the private sector.

The private sector has been very cooperative with our task force, and I had some provisions of the bills we were dealing with that would involve corporate tax credits for the involvement of the private sector in these centers and other issues relating to the private sector.

I expressed some reservations as to whether we really needed to do that because the benefit to the private sector of doing a good job in these areas is so substantial. We actually discussed that and had some very candid people on our task force who admitted that that was probably so, but I would also add that the corporate sector has to justify actions to the stockholders, to boards of directors, and it is not always easy just because it is the right long-term thing to do, as we know as it relates to constituents, to implore a body to do something. So these tax breaks may be communication tools, and while some of the costs involved may not be that substantial, they may give a reason to a corporate board or chief executive officer to become involved.

Third, to set up educational centers which, indeed, is the academic school concept, in which North Carolina provides excellent leadership. I remember when I first became involved in this area that we would like to think about creating an academic school. My question was, What are those things we have now around the State?

The residential issues and nonresidential issues, which I think are very complex from our point of view, and especially when you have a large geographical State with an urban and rural mix, you can't always have a nonresidential school, and if you do have a residential school, then you have some difficult questions.

With respect to that, there are discussions of elitism and who gets to go to these schools. My reaction to that is, I think we are dealing with an aptitude, not necessarily personal worth. I know that I probably would not have been going to an academic school of math and science and would probably not be interested in going to one, but the designation as to who goes to those schools doesn't strike me as an elitist issue. It is something I think we ought to deal with very directly. I think it is a skill issue and something that we need to promote.

Fourth, a grant program for exemplary teacher education programs. This, again, is to encourage recruits and talented people to stay in the field and to get into it. This is consistent with your scholarship program, and that particular issue was discussed directly by the task force and endorsed strongly. I think we would certainly be asking you to consider keeping that as part of the bill.

To establish and improve programs for in-service training. I think Mr. MacKay's comments were relevant to our State in particular, that the need for the skills and knowledge in teaching from an in-service point of view are critical. That is a title 1 issue, and I think section 624 is something that we would think would be important as well.

Establish a visiting scholars program. Visiting scholars is an interesting concept. That means you move someone from a university, private enterprise or higher education system into primary and secondary systems for a limited period of time. What is interesting, being associated with a university myself, was to see what kind of reaction you would have from professors. The reaction was very positive. If you have specialized classes in areas that they have an interest in—in other words, teaching an excellent class of science students in the 11th or 8th grade might be more interesting than teaching 120 students with a television as a freshman college course. So there is some interest in doing that, and the rotation of professors and primary teachers could benefit both.

Seventh, to activate programs designated to recruit teachers from around the country. This is a more parochial issue in the sense that we're dealing with recruitment and trying to identify ways to get teachers to come to Florida. That involves some complex issues of retirement funds and the types of things that are not easily resolved simply by a substantive education bill, but require some financing and I think some creative approaches.

We also mention the establishment of a teachers scholarship loan trust fund. Whatever support of this program would come out of the Federal level would be critical to us. I think ultimately we felt that this was a long-term issue, that the State has an elemental, local role, and the Federal Government has an overall guidance role, a very important role, which is currently being defined. In part 2, the chairman has an interest in the private sector role. I think the private sector needs to recognize the benefit of these programs long-term because of the skills available to them, I think the failure of our Nation to recongize the need of compentency in communication and technological expertise would be critical.

Those are basically the proposals, Mr. Chairman, that we are going to propose to the legislature. There are a lot of other points of discussion which I left out, and which I am sure will be pointed out to me by those that endorsed them. But those fundamentally are the areas.

We look forward to being able to work with this bill at the Federal level and the concepts that you and the Education and Labor Committee have developed.

[The prepared statement of Mr. Mills follows:]

TESTIMONY OF
STATE REPRESENTATIVE JON L. MILLS, CHAIRMAN
FLORIDA SPEAKER'S TASK FORCE ON SCIENCE, MATHEMATICS AND COMPUTER EDUCATION
BEFORE THE
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
FEBRUARY 8, 1983

Mr. Chairman, members of the committee, it is indeed a pleasure to be here today. Mr. Chairman, we've had many personal discussions over the years on issues important to our shared constituents, and I'm happy to have the opportunity to appear before your committee to comment on an issue that is deeply important to both of us—the ability of our country to maintain its competitive edge and in many respects to survive in an increasingly technological world. I commend you and your committee for your leadership, and for your willingness to move ahead on this issue.

It's also a special pleasure to be appearing at the same time before my friend and my new Congressman, Buddy MacKay, who is a new Member of Congress and a new member of this committee. For all of you who might not know, Buddy was a leader in the Florida Legislature, in the House and later in the Florida Senate, and while we hated to lose him, we're proud to have a man of his ability representing us here in Washington. Of course, I don't want to fail to recognize that we have two other distinguished Floridians serving on this committee who are also graduates of the Florida Legislature, Bill Nelson and Tom Lewis.

Mr. Chairman, as you know, for the past six months I have been serving as chairman of the Florida Speaker's Task Force on Science, Mathematics, and Computer Education. Actually, this task force is not just another blue ribbon panel, but an active working group. We were given the charge by our Speaker to specifically come up with legislative recommendations that the Florida Legislature will take up this coming Spring during our annual 60-day session. It's a distinguished group of leading education policy makers in Florida and includes not only members of the legislature, but our Commissioner of Education, the Chancellor of our state university system, representatives of our teachers unions, key legislative staff and others.

Because we have been addressing many of the same problems which you are addressing and because we have just finished our first draft report, it is particularly timely to have the opportunity to comment on the legislation before you today.

What became abundantly clear to us in looking at the status of mathematics, science, and computer education in Florida is that we have a problem and that we are not alone. It is clearly a problem national in scope that demands national attention.

One of the reasons our task force has been able to move as swiftly as it has is because much of the groundwork had already been laid and we only had to look at the abundance of well-documented evidence. As the Education Commission of the States pointed out in a special briefing to the Governors last August, "There is increasing evidence that the levels of mathematical and scientific literacy of American students has declined dramatically over the past 20 years. This decline is evidenced by the reduced quantity and quality of mathematics and science training and it is a significant threat to future U.S. economic and social well-being.

Some of the data which ECS has compiled and which documents the scope and seriousness of the decline in our competitive position includes the following:

- Between 1960 and 1977, the proportion of public high school students enrolled in science and mathematics courses declined; the number of students enrolled in science declined from 60 to 48 percent.
- Despite recent increases in mathematics and computer science enrollments, one half of all high school graduates in the U.S. take no mathematics or science beyond the tenth grade.
- Mathematics and science achievement, as measured by successive national assessments throughout the 1970s, have shown a steady decline. This decline has been least for 9- and 13-year-old age groups with increasing deficits for 17-year-olds.
- The effect of insufficient quality of mathematics and science preparation in the elementary and secondary schools is revealed by the fact that remedial mathematics enrollments at 4-year institutions of higher education increased 72 percent between 1975 and 1980—compared to a 7 percent increase in total student enrollments for the same period.
- Scores on the Scholastic Aptitude Test (SAT) for approximately one million college-bound students have declined over an 18-year period through 1980. The mean score in mathematics dropped from 502 in 1963 to 466 in 1980.

Therefore, I commend you for moving forward with emergency math and science legislation. I understand that what you are considering is a relatively modest approach and I understand the reasons the Congress will be reluctant to do more at this time. I also understand that some of you may have doubts about the federal government's role in helping to address the problems of math and science education, given the states' primary responsibility for education.

My answer after carefully studying much of the national data and the situation in my state is that what we have here is a national problem we can no longer afford to ignore. What we need is national leadership and assistance which will help the public understand the importance of instruction in mathematics and science and of the increasing importance of computer literacy. Furthermore, we need a combined effort at all levels of government. I understand the demands on the federal budget. We are also experiencing serious fiscal stress at the state level. But I don't think we can afford to wait any longer, even if we can only afford to take small steps at this time.

With regard to the details of H.R. 1310, the bill before you today, I would like to offer just a few comments. Part B is a modest, but important step which brings attention to the need to improve curriculum and help develop faculty at undergraduate institutions. I would hope that when you mark up this legislation you will give full consideration to not only the curriculum and faculty development needs of our four-year institutions, but also the needs of the many community colleges and technical institutions in this country which are responsible for training much of our technical workforce. Because industry needs so many technically trained workers in such high technology occupations as microelectronics, laser-optics technology, robotics, telecommunications, instrumentation technology, etc., companies are bidding against each other for workers that are available. Many of our younger, highly qualified instructors in these teaching fields are being lured from the classroom by higher salaries. This lack of sufficient vocational-technical instructors in our community colleges and technical institutions with state-of-the-art knowledge and state-of-the-art facilities is compounding the problem of a national shortage in technically trained manpower. Therefore, at least a portion of the funds to be provided for curriculum and faculty development should be reserved for community colleges and technical institutions.

Second, I want to commend this legislation for recognizing the importance of summer institutes as a cost-effective means of improving faculty in our schools. I would also encourage some provision, at the very least, to insure that federal money is not used to establish programs that are either inconsistent with state goals and objectives or that would unnecessarily duplicate already existing state programs. Any federal project should at a minimum be consistent with our state inservice and preservice training plans.

As with any problem of this magnitude, addressing it will require the concerted efforts of many groups and organizations. For that reason, I encourage you to endorse the concept of consortia in this legislation to promote the full participation of everyone concerned. Furthermore, I hope that you will attach as few restrictions as possible to the 50:50 match required. It has been our experience that programs of this nature are much more compatible with state objectives and priorities when those restrictions are kept to a minimum.

Regarding the special Engineering and Science Personnel Fund which is being proposed, I would also urge consideration be given to the needs of both our four-year institutions and our two-year community colleges and technical institutions.

I also hope consideration might be given to ways the vast research of the National Science Foundation could be tapped to help policy makers and education practitioners improve math, science, and computer literacy curriculum.

In Florida, the Speaker's Task Force on Mathematics, Science and Computers has spent the last seven months studying this problem and discussing alternatives. Our major goal is to adopt goals for K-12, because it became clear that to concentrate on the secondary level was not enough. We must begin in the early grades or a great deal of time will have to be spent in remedial education on the high school level.

To implement the goals, we intend to set forth a state comprehensive plan that will involve the cooperation of the Florida Department of Education, experts in the various fields, the private sector, professional organizations and associations, the local school district personal, the Board of Regents of the state university system, the Governor's office and the appropriate legislative committees.

I would like at this time, Mr. Chairman, to give examples of a few of the components of this plan.

First, the creation of a Mathematics, Science and Computer Education Quality Improvement Fund which will include, but not be limited to, the hiring of additional teachers and support personnel in the critical areas.

Second, the creation of regional centers of excellence in Mathematics, Science and Computer Education whose goals will include, but not be limited to, creating and maintaining an environment in which schools, community colleges, higher education industry and civic organizations can work together in assessing and improving education in their areas as well as make the most of resources and talents which can be used to enhance the field of study.

Third, to set up schools or educational centers for academically talented students to help them develop their maximum potential.

Fourth, to establish a grant program for exemplary teacher education programs to encourage the development of programs that recruit and train talented people who hold degrees in the liberal arts, sciences or engineering.

Fifth, to establish improved programs for in-service training for teachers who need to update their skills and knowledge in order to keep pace with the ever-increasing flow of new ideas and technology.

Sixth, the establishment of a Visiting Scholars Program to bring current academic information in the various disciplines to students and faculty in the state's public schools.

Seventh, to activate several programs designed to address the shortage of qualified teachers in fields designated as critical teacher shortage areas. These would include a program of active recruitment, the establishment of a program to purchase prior out-of-state retirement benefits, the establishment of a teacher scholarship loan trust fund, a student loan forgiveness program, and a critical teacher shortage tuition reimbursement trust fund.

Mr. Chairman, those are just a few of the ideas that the Speaker's Task Force on Mathematics, Science and Computers will be recommending to the Legislature of the State of Florida in April.

In conclusion, we have a major problem before us. I am hopeful that we will all be able to move forward quickly in a combined federal, state, and local effort to meet the technological needs of all our citizens which are essential to the future of our country.

The CHAIRMAN. Thank you very much, Jon.

As is our practice, we will hear from all three of our witnesses and then we will have questions.

Dr. Phillips, we will be pleased to hear from you at this time.

Dr. PHILLIPS. Thank you, Mr. Chairman, for the invitation and opportunity to appear before this distinguished committee, and also a word of appreciation to Congressman Valentine for his efforts on behalf of this testimony, but more importantly, a sense of pride in Congressman Valentine now having come to the national scene as one of our distinguished Congressmen, after many years of tremendous leadership as a decisionmaker, particularly in the interest of educational progress of the State of North Carolina. I am delighted that he now sits in Washington in this important role.

The CHAIRMAN. We are very delighted to have him, too.

Dr. PHILLIPS. Thank you.

And if I could have one other personal privilege of expressing a longtime friendship and admiration for Congressman Simon, having had a long working relationship with him in the field of international studies and foreign language, serving on the National Council for International Studies and Foreign Language, an outgrowth of the President's Commission on the study of those areas, and an expression of real support for his concern at the national level about foreign language and international understanding and all that is implied with that as we also deal with the world of technology and math and science. I think there is a strong relationship. He and I have worked long and hard in that area and I admire him for that.

I am pleased to have a chance to present very briefly the North Carolina story. I have prepared testimony, Mr. Chairman, and would appreciate that being entered into the record.

The CHAIRMAN. Yes. Without objection, we will make the statement a part of the record, and if you wish to summarize, certainly feel free to do so.

Dr. PHILLIPS. I shall very briefly summarize that and then would be happy to be a part of the question-and-answer session.

The needs have already been well-documented. It is not simply a national problem but also a State problem, and I make that point because I represent here today the voice of a constitutional body in North Carolina, the State Board of Education, that is charged through its constitution and its laws with the administration and supervision of a uniform school system for North Carolina, and is a strong, responsible voice for elementary-secondary education. I also speak for Gov. Jim Hunt, who has exercised unique leadership in educational growth, and a particular interest in math and science. So I speak from a vantage point of a State that has made some clear commitments and, more importantly, a clear set of plans about what needs to be done in math and science education in that State.

We have taken some steps. They are outlined in the testimony. I just want to mention them as seeds for discussion.

We are in the business of summer institutes now, primarily geared for elementary teachers, with heavy emphasis on the middle grades—a specific program planned over the next 4 summers dealing with some 1,800 teachers and some 140 institutes that tie in with the concept of this legislation.

We are talking about extended employment of math and science teachers. A proposal is before the State now and our legislature. The beginnings of that call for the extension of employment of teachers in math and science to the degree of improving both the incentive for employment, getting back to that said earlier about jobs and opportunities, but even more importantly, to put emphasis on staff development, on working longer with kids, and all that is involved in extended employment.

We are in the midst of curriculum studies which provide for a whole new look at mathematics and science education in the State of Carolina, from kindergarten through the 12th grade, with a much clearer definition of what is to be learned, at what moment should it be learned, and in what way should it be learned, even to the point of a full set of competencies from the very beginning of an understanding of numbers, and moving through the sequence of mathematics understanding and science, along with the other discipline areas, to a point where we believe we know better what those targets ought to be. That gets into the business of how you train people to do that.

We are in the midst of developing model programs in selected administrative units in which better ways to do the job of both training teachers and dealing directly with kids is involved. We have used some of the chapter 2 moneys, the ECIA moneys, in educational technology, with specific emphasis on model ways to do that job, and we are dealing with upgrading skills of now certified teachers, particularly at the secondary level, to bring new information and new ideas in math and science through institutional experiences for those people.

The lighthouse of the focus on math and science education in North Carolina is truly the new North Carolina School of Science and Mathematics, which has been spoken of already. You have the materials there, and I hope you will look carefully at the marvelous array of information about the creation of, the development of, the philosophical base for, and the operational base for all of this. I would say to you, without spending the kind of time I would like to use for bragging a little bit about it, to say to you that it is working. It is not only effective in what it is providing in an educational opportunity for 400 youngsters today, and eventually 900 in North Carolina, who have come through a very extensive selection process, which includes affirmative action, which includes geographic representation, which includes all of the factors moving towards that full representation, Jon, that you talked about in terms of the make-up of the school. It is effective and is producing results for the youngsters.

But much more importantly, I think to this committee, is its impact on the whole world of math and science, in North Carolina, and its importance. It is now serving as a catalyst, if you will, as a medium for pushing and shoving and stimulating, what is going on across North Carolina in all 143 school systems, and in the 2,000 schools from which these now 400 and eventually 900 youngsters have and will come. Workshops, a full year-round commitment of that school's services, heavily into the training of teachers, internships with key teachers coming in to spend a year working in that kind of environment, are kinds of evidence that this lighthouse program is much more than simply an additional experience for 400 youngsters.

I am not sure, when you talk about the justification of funds and the rest, that we could justify that expenditure solely on what it is doing for 400 youngsters. That is a major component, but it is a much larger investment. I think that has to do with the impact of this legislation and its effect the quality of what happens out there. There is much evidence of that, and I hope you will look carefully at that as one way in which that focus can be made.

We are in the business in North Carolina of specifically looking at continually rising standards. Our State board of education has just moved from 18 required units for graduation in North Carolina to 20, and most States are in that turmoil now of who should establish, at what level, how many requirements. That reflects a stronger commitment, to some of the questions asked earlier, about the broad curriculum and broad numbers of electives. I think we are coming closer to a tightening up of what elements of a full "bucket of education," if you want to put it in that sense, of what should be there. The State board of education, again with its responsibilities, is coming closer to that definition.

In addition to that, it has just begun a program—reflecting again some strong interest in math and science, but in a broader sense, a higher standard—of what it is calling a North Carolina scholars program. This will, in effect, be the State board of education saying through a local school system to a youngster:

> If you complete a set of requirements that go beyond the call of duty, in terms of additional units, but more importantly, the spelling out of four mathematics units and three science units and two foreign languages and these kinds of things, and maintain a level of measurable success, North Carolina will designate you beyond your graduation credentials as a North Carolina Scholar.

Again, not anything of a magic quality, except that it puts that emphasis again on that kind of level.

Prospective teacher scholarship loans, a program in existence in North Carolina for many years, is now concentrated heavily, prioritywise, on potential teachers of math and science. Our Governor's schools which began in 1964 under the leadership of then Gov. Terry Sanford have a strong emphasis on math and science, some 800 youngsters each summer, in two settings, where the emphasis again is on gifted and talented youngsters, selected with a renewed and stronger emphasis, and again used for teacher development and training.

We have undertaken a quality assurance program in North Carolina which we will discuss this week in New Haven, as the leadership in higher education across this country and the chief State school officers meet under the auspices of the Carnegie Foundation, with former U.S. Commissioner of Education Ernie Boyer and a number of other people looking at how you find excellence in teaching. The quality assurance program in North Carolina reflects a relationship between the board of governors of the higher education system, and the State board of education which have said we must find a whole new cycle of entry into, improvement of and what happens in teacher education, clearer exit requirements, but much more important than any of it, an oversight in terms of evaluation of the level of performance and competence coming out of that program and the continuation of that cycle, again heavily looking at the preparation of teachers in mathematics and science, but in other areas, but with some priority there.

The recognition of the business interest is strong in North Carolina. Governor Hunt, as the new chairman of the education commission of the States, has made a strong push for a concept of education for economic well-being and has brought together in our State, and now nationally, a task force of top business leadership that has taken a look at all of this. That has had its effect also in North Carolina through a committee on science and technology that has had a part of developing this plan and, very importantly, gives to it support and direct influence for decisionmakers to provide resources and the like.

Putting it all together, I would say to you, speaking from one State, although we have strong plans—and they are not simply on paper—they're at work now, we think we know where we are and where we want to go, what kind of strategies we will use to get there, where we will put our priorities and how we will measure the effectiveness of what we do, I think our planning process is solid. In fact, our accreditation program in North Carolina for the 143 school systems is built around the existence of a plan for a comprehensive educational program, including math and science education.

We can't do it alone in North Carolina, nor can 49 other States do it alone. We believe that the State, by the very nature of the educational enterprise in this country, and its greatest feature of diversity and State responsibility, is the place where education has its prime responsibilities, carrying through with local levels the job of working with kids.

We need the partnership relationship, that is reflected in this legislation, and it would be our hope that through this legislation, it would be geared heavily to the improvement of the level of quality and competence of those who work in the educational enterprise, because what happens to youngsters in the learning process is directly related to the quality of the people who work with those youngsters. It would be our hope that this legislation, as it is now developed, would concentrate heavily on helping us, through a higher education commitment and an elementary and secondary commitment, to put together the kinds of programs that improve the level of quality of those people.

Thank you for letting me make this statement.

[The prepared statement of Mr. Phillips follows:]

TESTIMONY
BY
A. CRAIG PHILLIPS
NORTH CAROLINA SUPERINTENDENT OF PUBLIC INSTRUCTION

Chairman Fuqua, Congressman Valentine, and members of the Committee on Science and Technology, I am Craig Phillips, Superintendent of Public Instruction in North Carolina. It is indeed a pleasure for me to have the opportunity to share with you North Carolina's concerns and its plans to deal with a recognized national problem -- improving instruction in science and mathematics. Today, I will not bore you with additional statistics; the situation is already well-documented, and you have heard testimony indicating the magnitude of the problem.

While recognizing that the quality and quantity of instruction in science and mathematics is a national concern, the State of North Carolina has begun addressing the problem. Our needs are complex. The shortage of qualified math and science teachers, the lack of adequate equipment, materials, and facilities, decreasing enrollments in science and math programs, and teacher salaries far below those paid by industry mandate that the solution to the problem be a multi-faceted one. Through the efforts of Governor Jim Hunt, the State Board of Education, the Department of Public Instruction, numerous organizations and study committees, the State has initiated a series of activities which are addressing the issue, as follows:

I. Six Week Summer Institutes for Math/Science Teachers in Grades 7-8

In an effort to improve the background of 1,800 mathematics and science teachers who lack appropriate training, 140 rigorous summer institutes are scheduled to be conducted in North Carolina if requested funds are made available from the N. C. General Assembly. These institutes are planned for the next four summers. Math and science content will be stressed throughout the institutes with particular attention being given to linking teaching methodology and subject content. Institutes will be located throughout the State on college/university campuses, in LEA facilities, and possibly in community college facilities. Participants will primarily be 7th and 8th grade teachers. Each institute will be held in cooperation with a college or university, and all institutes will be conducted by college and university instructors. Approximately $6,000,000 will be required to fund these institutes over the next 4 summers.

2. Extended Summer Employment for one-third of Certified Science and Math Teachers

The State Board of Education, at its November 1982 meeting, requested $7,800,000 from the N.C. General Assembly over the next 2 years to employ one-third of the fully-certified science and math teachers in grades 7-12 on a 12-month basis. This effort would involve 960 science and math teachers. The Governor has also requested funds, although a lesser amount, from the General Assembly. The purpose of extending employment for these teachers is twofold: (1) to attract and retain better math and science teachers; and (2) to improve the science and math programs and offer more opportunities for the students during the summer. Teachers participating in this extended employment will be involved in activities such as:

A. Developing computer software
B. Developing outdoor/environmental learning centers
C. Providing school-level math/science leadership and training to other teachers

D. Teaching advanced math/science courses in the summer.

E. Developing innovative science/math curriculum plans and laboratory experience

F. Involving business and industry in science and math programs.

By employing qualified science and math teachers during the summer months, opportunities can be provided for these teachers to positively affect science and mathematics instruction for North Carolina students.

3. Curriculum Studies

Detailed curriculum studies in science and mathematics have been initiated by the State Board of Education. The study for science has been completed; the mathematics study will be finalized by June 1983. The quality of the science and mathematics programs in the schools will improve dramatically as recommendations contained in these studies are implemented.

Curriculum improvement is a continuous necessary task if the schools are to offer programs which prepare students to live productive lives in a dynamic, technological society. The North Carolina State Board of Education has documented its commitment to curriculum improvement as important and necessary to the success of the students served by the schools.

4. Model Programs in Mathematics and Science

Using $240,000 of federal, state, local, and private funds, eight secondary schools will be selected later this year to establish programs of excellence in mathematics and science. These programs will serve as model programs in science and mathematics. The programs will serve as demonstration sites where teachers and leadership staff from other schools can come to observe excellence in science and math instruction. A concerted effort will be made to involve the total community in planning and implementing these exemplary science and math programs. A variety of laboratory opportunities will be provided in these model programs to enhance both the mathematics and science programs. Student involvement in in-depth learning experiences in these labs will be the primary purpose of the laboratory thrust.

These model math and science programs in North Carolina will clearly show how high quality instruction can exist in any school which has adequate financial support and enthusiastic, effective personnel.

5. Education Consolidation and Improvement Act: Chapter 2 (Education Block Grant)

The North Carolina State Board of Education has demonstrated its concern for math and science and related areas by targeting over $300,000 of State Block Grant funds to go to LEAs for the development of model programs in educational technology. During the past 6 months, these programs have been investigating effective techniques for training teachers and students in computer programming. In the Chapel Hill school system, for example, advanced students are used as tutors for other students and for faculty members. Other programs are examining the effectiveness of various computer uses; for example, the computer lab approach is being compared to both regular classroom application and to mobile use of computers. Results from these projects will enable school systems across the state to know more about how to effectively use our rapidly changing computer technology.

6. Programs to Upgrade the Qualifications of Teachers Who Are Certified in Secondary Math or Science

Pending $200,000 in funding from the legislature, North Carolina will implement a program over the next two years to update and improve the background of properly certified mathematics and science teachers. The program will consist of carefully developed courses, primarily emphasizing content, which will be offered at designated colleges and universities located throughout the State. At these institute sites, teachers will be able to receive: (1) additional content training and/or (2) enrichment in recent scientific and technological advances. While some course offerings may be new, others may be regular courses offered by the institutions.

In another part of this effort, teachers will be selected (60 mathematics, 40 science) to receive individual $1,000 grants based upon the submission of a detailed Self-Improvement Plan covering from one to three years. The Plan must have been developed cooperatively by the teacher, his/her immediate supervisor, and a representative from the content area at the institute the teacher plans to attend. The Plan must demonstrate the need for additional training, how this training will enhance the teacher's effectiveness in the school setting, and some indication that the teacher does, in fact, plan to remain in teaching. While the $1,000 grants will be made on a yearly basis, teachers may compete for and receive awards for one, two, or three years. The grant money may be spent for payment of tuition (at least 6 hours), fees, travel, or subsistence.

Mathematics and science teachers must be aware of rapidly changing knowledge in these fields. This program to upgrade teacher qualifications will help accomplish the task.

7. The North Carolina School of Science and Mathematics

On June 16, 1978, at the request of Governor Hunt, the General Assembly established the North Carolina School of Science and Mathematics. This residential school for gifted and talented high school students with strong interests and unusually high potential in science and mathematics is located in Durham. The school presents a challenge of attainment of educational excellence to its students, to their parents, to the faculty, as well as to the educational, scientific, and civic communities throughout the state and nation. The school opened its doors to students in the fall of 1980. It is in its third year of operation with approximately 400 students.

Fifty-eight National Merit Scholarship Semifinalists were selected from among the 153 students at the school who took the qualifying PSAT last October. With a student body of 388, NCSSM is second in the nation in number of students selected following Stuyvesant High School in New York with an enrollment of about 2,600.

One of the school's interests is to strive for improved science and math education in the elementary and secondary schools throughout the state. Computer institutes have been conducted at the school by its staff during the past two summers for 350 science and math teachers from schools across the state. Staff development activities of a different nature are being planned for next summer for similar teachers. As the school continues its efforts to assist local school systems upgrade their math and science programs.

8. North Carolina Scholar's Program

On February 2, 1983, the North Carolina State Board of Education approved, in concept, a North Carolina Scholar's Program which encourages students to pursue a thorough and demanding high school program. Twenty-two credits are required in addition to an overall "B", four year, grade average. Under this program, 4 years of math are required along with Chemistry, Biology, and Physics. This program will encourage North Carolina students to pursue a vigorous curriculum in science, math, and other areas. It will also provide recognition for students who successfully complete the program. Students would have special N.C. Scholar Seals affixed to Diplomas. They could also be eligible for special scholarships offered by business and industry; business leaders have already approached the State Education Agency to explore possible scholarship assistance to students in the N. C. Scholars Program.

9. Prospective Teacher Scholarship Loan Program

For many years the State Board of Education has administered the Prospective Teacher Scholarship Loan Program which provides loans to prospective teachers. If persons receiving the loan agree to teach for four years, they do not repay the loan. If individuals teach for less than four years, they must repay the loan on a prorated basis. Priority has been given to making loans to prospective math and science teachers, and last year (July 1982), the per year amount was raised from $900 to $1,500.

High School seniors and undergraduate students are recruited to go into teacher education (science and math) and apply for loans. Information about the program is sent to all school systems each year. Counselors and student advisers work with students interested in applying for loans. Math and science educators in colleges and universities are also informed about the program, and are asked to encourage their undergraduates who are interested in math and science teaching to apply for loans.

With math and science being emphasized and the Loan Program being publicized, there will not be enough money available to meet the demands. It is anticipated that an additional $200,000 per year, for the next two years will be needed to enable the program to serve requests from prospective math and science students.

10. Governor's Schools

In 1964, under Governor Terry Sanford, North Carolina established the Governor's School in Winston-Salem. This project provides advanced learning opportunities in the summer for gifted students in the Arts, sciences, and humanities. In recent years, enrollments have been high in math and science areas. An additional campus has also been opened in Laurinburg; this makes it possible for us to serve 800 gifted North Carolina students during the summer.

11. Quality Assurance Program

To upgradeand ensure appropriate certification of new math, science, and other teachers, a Quality Assurance Program is being formulated by the State Board of Education and various individuals and committees from across the state. During the first two years of employment, new teachers will work under the close supervision of local school staff and professors from teacher training institutions. If new teachers receive adequate evaluations after two years of teaching, they will receive "permanent certification."

It has been recognized for some time that four years of college, by itself, does not adequately prepare one to become a teacher. The extended two-year term provides an important supplement to the four-year college education which math and science teachers traditionally receive.

12. Committee on Science and Math Education

In the fall of 1980, a Committee on Science and Mathematics Education was established jointly by the North Carolina Board of Science and Technology and the North Carolina Department of Public Instruction. Its goal was to develop procedures for increasing the interest and proficiency of high school graduates in North Carolina in science and mathematics.

The full Committee was active for approximately two years, and subcommittees continue to meet. The final recommendations of the Committee for improving science and math education in North Carolina are summarized as follows:

A. Longer terms and higher salaries for Science and Mathematics Teachers
B. A Grant (Scholarship) Program for Teachers of Physical Science and Mathematics
C. Locally developed programs to improve math and science teaching.
D. Improve teacher competence through stronger teacher education programs.

The Committee's report containing recommendations was presented to the State Board of Education in March 1982. A series of regional forums are currently being held to encourage local community awareness concerning science and math education.

13. North Carolina State Board of Education Resolution Concerning Math and Science

At its January 1983 meeting, the State Board of Education passed a Resolution. The Resolution stated the Board believed science and mathematics education are essential and one of the state's priorities. Additionally, the Resolution encourages LEAs to join the Board in efforts to improve science and mathematics education in North Carolina. A copy of the Resolution is shown below:

> Whereas, America has long relied upon ingenuity and technological advances in order to maintain its competitive advantage among other nations of the world; and
>
> Whereas, the State of North Carolina has an economy which is becoming heavily based upon high technology industries; and
>
> Whereas, student achievement in science and mathematics courses has fallen behind student achievement in many foreign countries; and
>
> Whereas, the enrollment in upper level mathematics and science courses has declined to, and remains at, an unacceptable level; and
>
> Whereas, science and mathematics are the foundation upon which society will continue to depend for its basic welfare and security in a competitive world where natural resources are finite.
>
> Therefore, be it resolved that the State Board of Education believes the improvement of instruction in math and science to be essential and a state priority; and
>
> Be it further resolved that the State Board of Education encourages LEAs to join the Board in an effort to find creative ways to improve science and mathematics education in the schools of North Carolina.

While the above steps will not produce the total solution, they are important components of a comprehensive plan. State and local resources are inadequate to do the job. A partnership with the federal governement is essential if we are to make real progress in North Carolina and the Nation. The fact that science and mathematics are critical to the national defense and to a labor supply trained for modern technology indicates that assistance in this area is appropriate to the federal role in education. Not since passage of the National Defense Education Act, in response to the Russian Sputnik, has the Congress or the states given adequate attention to science, mathematics, and technological instruction. It is now critical that we work together to find a solution to immediate and long-range problems if we hope to improve our economic and industrial outlook. Especially in this time of high deficits and shrinking resources, I commend you for your efforts to attack the problem through the "Emergency Science and Mathematics Education Act" and the "National Engineering and Science Personnel Act." I assure you that your efforts along with ours will pay economic and social dividends in the future.

As you debate the issues in this important legislation, I urge you to allow States the flexibility to mesh these programs with those that have already been initiated by the States. At the same time, I recommend that you not fragment the legislation into so many small categories that the limited funds will have little or no impact.

Mr. Valentine, we are especially pleased that you have asked us to share our thoughts and our action on this crucial subject. Mr. Chairman and members of the Committee, North Carolina stands ready to work with you in strengthening programs in mathematics, science, and technology.

The CHAIRMAN. Thank you very much, Dr. Phillips.

Dr. Pettit, we would be pleased to hear from you as the president of an institution of higher learning.

Dr. PETTIT. Thank you very much, Mr. Chairman, members of the committee. I appreciate the opportunity to appear before the committee.

I guess we move along the scale now still farther toward the elite end of the spectrum. With no apology, my comments will be toward title 2, the national engineering and science personnel sector. I am all for literacy and science and mathematics. I think the Nation needs it. I am also aware that the primary and secondary schools are the source of the people who will eventually end up with Ph.D's.

Putting it in an oversimplified way, perhaps, I could say that the innovations that the students under title 1 will read about, and the products that they will buy and use, will depend on the students who will be helped under title 2. If the computers that we continue to buy and the aircraft we continue to fly in, world around, are American, it will be because of the students that you are going to help under title 2.

I speak, therefore, as perhaps your only witness today on behalf of the research universities and their role in this. Their participation under title 2 would be most important.

I presume to advise after 14 years as dean of engineering at Stanford University, and the past 11 years as president of the Georgia Institute of Technology. During that time Georgia Tech has grown tenfold, and our research grants and contracts are now running $77 million a year. We are typical, I think, of the major research universities.

Personally, I come as a member of the executive committee of the National Association of State Universities and Land Grant Colleges. I am a recent member of the National Science Board, a member of the Committee on Science and Engineering and Public Policy of the Joint Academies, as well as a member and former council member of the National Academy of Engineering and formerly president of the American Society for Engineering Education. So I have been very much involved in the subject matter that is before you.

I do immediately want to commend and support H.R. 1310, especially title 2. I think it is a recognition and a statement of a national concern and a national commitment to scientific and engineering leadership. This transcends the basic role of any individual State to provide education to its citizens appropriate to its own needs. Most States will be exporters of their own advanced graduates to the high technology centers of the Nation.

There is and must be a national statement if we are to remain competitive in productivity and industrial innovation, if we are to continue our role as leaders in high technology defense.

There are several positive aspects of the bill which should be commended particularly. It addresses the problem of the depleted pipeline of graduate students in engineering and science. For example, the annual Ph.D. output in engineering has been declining since 1972. Students need better financial incentives and support in order to continue their education to higher levels, rather than taking attractive jobs in industry at the baccalaureate level.

The bill also addresses the faculty shortage by providing for startup research support for new, young faculty, and for better equipment for their research, incentives, if you will, to help young people who have the ability to make those marginal decisions that they make every day, every year, in favor of continuing their education and, for some of them, becoming new faculty.

The bill recognizes that our research universities are not only sources of these advanced level students and faculty, but they are, indeed, the focus of nationally important basic research. We are, in fact, research performers as well as producers of the manpower that industry and Government need after students complete their master's and doctor's degrees.

The bill places administrative responsibility in an agency well suited for the task—the National Science Foundation. I say this advisedly from many years of contact with NSF, as an adviser, as a grantee, and as a recent member of the National Science Board.

The bill has certain deficiencies, as must every bill. It is deficient in scale. More than $100 million is needed to make an adequate impact, even with the added $100 million to be provided from matching funds. Nevertheless, the bill makes an important symbolic statement to the Nation, to its engineers and scientists. And the issue can't be solved in 1 year, so the intended follow-on funding under title 2 must be pursued for the 5 years that have been laid out there.

Finally, the bill includes matching or cost sharing at the 50-50 level. Conceptually, this is all right. We have lived with it before with the National Science Foundation equipment grants. It does double the Federal money, and it also doubles the local money. And it influences local funding priorities in a desirable way, up to a point. But it does put a limitation on the objectives of the bill; too much matching money for specific programs can distort excessively the program balance in an institution and beyond some point may not be acceptable.

And local funds may not be available in adequate amount, or in proportion to the potential of a State, or an institution in the State, to contribute to the objectives of the bill. But these are quantitative limitations, not conceptual.

In conclusion, I would again commend this bill for its important statement and actions and would urge its adoption.

Thank you, Mr. Chairman, for this opportunity to participate in the work of your important committee.

The CHAIRMAN. Thank you very much, Dr. Pettit.

We appreciate all of the witnesses. I think you have enlightened us from three different perspectives.

To you, Jon, and Dr. Phillips, I would like to ask, coming from the legislative standpoint and administrative standpoint, do you see anything in H.R. 1310 that seems to be incompatible with the efforts of the State legislatures or State administrators, incompatible with either ongoing or proposed efforts that you are proposing?

Dr. PHILLIPS. Mr. Chairman, the answer would be, first, no. There is great compatibility in terms of the overall plan that is there.

One area that I think needs to be looked at very clearly is the relationship that is implied between higher education and the State educational leadership, whether it is the SEA or the elementary-secondary leadership, whatever it is. It is important, I believe, to recognize and maybe call more clearly, as is called on one side of it, for a coordinating role between the two. In other words, the mandate to do things together between the higher education institutions and the State agency. I think it needs to work both ways, as is reflected in one side of the legislation but not in the other. I believe that is one of the places where it may be strengthened, so that in the work in summer institutes and in the programs, that some kind of mandated, coordinating influence be reflected in the legislation. That is left out, I think, on this side of the piece of legislation.

The CHAIRMAN. Jon.

Mr. MILLS. Mr. Chairman, I guess the plan, generally, I think, is perfectly consistent. The only caveat would relate to assuring us or providing some guarantees that we aren't going to try to duplicate ourselves at the local, State, and Federal level. So coordination is the key.

The CHAIRMAN. But the task force that you headed up in Florida seems to be, from my notes as you outlined, very supportive and compatible with what the objective of this bill is.

Mr. MILLS. No question about it.

The CHAIRMAN. I believe the state would be able to augment some of the problems that maybe were contained in H.R. 1310.

Mr. MILLS. Yes, it would just be a matter of one of those issues which is always difficult, which is to make sure that each level of government does what it does best, school boards, State education departments and legislatures and congressional committees.

Sometimes we get confused, and the legislature certainly confesses to getting confused from time to time. I think we all are trying to achieve the same thing, and it is an intergovernmental relations issue that we can sort out when we communicate like this.

The CHAIRMAN. Dr. Pettit, you have addressed your remarks primarily to title II. One of the concerns you expressed was that maybe the matching funds may be out of tilt.

One of reasons that we came up with this idea was after visiting and consulting with industry and those who were concerned about higher education, it appeared that it would be rather easy to attract that type of money from industry because they will benefit from this.

They are concerned about eating our seed corn as it relates to the number of researchers or faculty, and they see their source or supply of information, as well as people, to be severely jeopardized under the current regime that we are operating in now, where less and less, as you pointed out, are going into graduate studies.

Where do we find ourselves 10, 15, or 20 years from now when we are looking for someone to be working at Georgia Tech and other institutions, performing research as well as teaching? How much of a concern do you have about the matching funds?

Mr. PETTIT. I would say I have no initial concern. I think it is just going to be a limiting thing on how far we can go in this direction. State universities of any substance and leadership are already working in the private front as heavily as we can. We have brought in $10 million in gifts and grants during the past year.

So, in a way, I think—of course, the scale is such that if you take $100 million and divide it by 50 States, that is $2 million per State, and it is pretty hard to say that you can't find $2 million either from the legislature or from the industry or some combination thereof.

But if one talks about balancing the programs of an institution, it is hard to convince other parts of the institution that you couldn't have gotten that $2 million for them just as well.

In fact, you will divert—I think in concept it is not bad. It does a couple of things for you at the present time. It would stimulate more responsibility and response on the part of the State to this national cause. It would influence priorities in the allocation of funds by legislatures and boards of regents, but not too heavily.

I think it needs watching so that if you were to do either of two things, either to say after thinking about it very carefully the $100 million really wasn't enough and wanted to move up to $200 million or $300 million, then the matching would get a little more precarious. Or if after a year or two of operation, the results are deficient, then perhaps back off on the matching or add more money without the matching.

For certain kinds of things matching is more relevant, but from the private sources, of course, there is a limit from their responsibility to shareholders and to their own internal operation.

If corporate scholarship matching support is going to students who go to work for competitors or for the Government, then it sours after a while. At this stage, it is not bad.

I think it also has certain political viability perhaps in that it is harmonious with the concept that education is primarily State and local and that the role of the Federal Government ought to be to make statements showing concern on a national basis, but also stimulating the States to do more toward this concern.

The CHAIRMAN. Thank you.

Mr. Gregg.

Mr. GREGG. Dr. Phillips, first I want to congratulate your State on all that it has done in this area. It is a superb example for all of us. You not only have a lighthouse for a high school, but you have a lighthouse for a whole program, it would seem to me.

I am sure New Hampshire, since we are on the crest of the wave of high technology, being near the MIT-Harvard spinoffs—and nobody is leaving MIT and Harvard wanting to go to Massachusetts, all of them are wanting to come to New Hampshire—we are very interested in this whole issue.

I guess I am impressed especially by the fact that you have done it all on your own as a State. One of our issues that we have to confront in this committee is how we relate NSF and the Department of Education. Which turf should we be on?

I would be interested in your experience in dealing with NSF and the Department of Education; what functions you think could be best administered by NSF versus the Deparment of Education; and how you think that we should address this whole issue of the Federal turf problem.

Mr. **Phillips**. Without any magic answer to that, I think the balance, as I understand the thrust of this legislation, is pretty well found between the two.

It is my strong impression that a State education agency that will carry the prime responsibility for many elements of this would receive its resources and its direction in the sense of the broad scope from the department of education itself.

We have had a fine working relationship with those funds and those thrusts from the National Science Foundation that have resulted historically over the last number of years in institutes working in relationship with higher education and the rest.

I would suspect that the balance, as I understand it, that is now reflected in the three parts of the legislation, is probably about as it should be as it would affect us at the State level.

My plea, in a more general sense, is that the funding that comes and the stimulation that comes out of this legislation allow for that prime initiative to be taken at the State level within that planning process for the different elements and the ways in which math and science education will be improved, with the heaviest of the emphasis on the training, the staff development of the people who are involved in the retraining.

I don't know whether that gets at what you are dealing with. As I understand the balance, I believe that is about right as it would reflect on a single State.

Mr. **Gregg**. If I could capsulize what you are saying, you are at a level of development in your program where you basically like the money and want to be able to make the decisions as to how it is spent?

Mr. **Phillips**. Yes; I happen to believe strongly, and have for a long time, in our position as to some of the other things that have been said about the Department of Education.

I am one of the strong supporters of a strong Department, a voice for education in America and that place around the Cabinet table that speaks to the importance of education.

I think that the Department of Education potentially could be the conduit through which major change can be made in math and science education without the dominating factor as much as the stimulating, the catalytic part of it. I happen to believe in that very strongly.

Mr. **Gregg**. On a specific area, for example, the summer institutes, I notice you have scheduled something in the order of 140 summer institutes over the next 4 years which you are going to fund out of your State budget.

If we set up summer institutes, would summer institutes run by the National Science Foundation be something that would be helpful to your proposal?

Mr. **Phillips**. Yes; I think it would be compatible with our program. The summer institutes which I mention here will be funded primarily with State resources, and will be carried through by the State education agency in collaboration with higher education.

There are requirements for involvement of both. The National Science Foundation kinds of institutes, I think, would be compatible with it. It would just be more of what we don't have enough of now, so I don't think there is any conflict with that.

Mr. Gregg. I would be interested in Mr. Mills' or Dr. Pettit's comments on the turf issue, if you have any.

Mr. Mills. Being in a State legislature we have a lot of turf issues as well. I sense a little bit of this here. I had some acquaintance with the NSF when I was in the academic world, in writing one of those proposals.

They have an interesting approach to thorough evaluation. This seems to be a source of the creative work we need done, to be able to tell the educators who are in the field how to teach.

There are some interesting statistics in that that I know are going to have to be evaluated. For example, in the 6th grade, when they survey the children there, how interested they are in a career in science, and when they survey them in the 11th grade.

The dropoff in percentages are incredible. Somewhere along the line we have to learn something about learning, and that is not easy to do when you are on the line with 30 kids, or trying to administer a school.

It seems that you have a logical division, but there is a lot of work to do, as Dr. Pettit has said, to determine how we are going to use those resources and those large bucks that we are going to have to generate to pay for more teachers and to pay for more people to teach those large classes with the creative aspect of it.

The part of title II that deals with research is critical to us as a State government. We are going to have to allocate funds to the classrooms.

Mr. Gregg. Thank you.

Mr. Pettit. I wouldn't add very much on that. I am familiar with the NSF, what it does and how it does it. It does certain things very well.

I would just kind of oversimplify and say if the content is important, the science content, the math content, then the NSF is probably very well suited to doing it. Or if the content is so new that its pedagogy is not well established, they might still be best able to do it. As you move into more conventional things, pedagogy is more important and their uniqueness is perhaps diminished.

Mr. Gregg. Thank you.

The Chairman. Thank you, Mr. Gregg.

Mr. Valentine.

Mr. Valentine. Mr. Chairman, I don't have any questions. I would just like to say to Dr. Phillips that I think his appearance here demonstrates to all of us why public education in North Carolina fares so well.

Thank you.

The Chairman. Thank you, sir.

Mr. Walgren.

Mr. Walgren. Thank you, Mr. Chairman.

I would like to go back to the subject of the turf disputes and wonder if there are any further comments you gentlemen have because I think that is a real important subject, that we do have such difficulty coordinating the efforts made by departments of the Federal Government.

Do you feel that in some of these functions there should be either one or the other Federal agency involved? I would like to address that to all three of the panelists, if I might.

Mr. MILLS. Everyone is leaning back.

I guess the question is, is duplication justified? In other words, in all circumstances do we need to designate it in one way or another, or do you need to? Is that what you are saying?

Mr. WALGREN. It seems to be perhaps two questions. One is, what is the effect of duplication. Perhaps before you get to that is the question of whether one of these agencies may be more suited to perform well than the other in a specific program area, such as are suggested in this range of part (B). I am just very concerned that some wrong things and some slippage will occur if we get both involved.

Mr. MILLS. I think if the thrust of what I heard Dr. Pettit say, who may have more experience in dealing with the NSF in this kind of thing particularly, that when you are dealing with the private sector and you are dealing with new frontiers, the NSF seems to be the more justifiable place to go, and that when you are dealing with fundamental education issues and the administration of programs, the Department of Education is better.

Then the issue is how the Department of Education supervises or attempts to deal with programs, all the way down to the school board level. I think we have some of the same problems at the State level, obviously, between the Department of Education and school boards and boards of regents and research versus application.

From my point of view, it seems to be a fundamental guideline, that if you are doing something in esoteric research, it is justifiable that it be done through the National Science Foundation.

Mr. WALGREN. Is there anything in the concept of breaking new ground versus delivering a program that is extant at that point, that is existing, that people have a pretty good conception of what it should do and how it should do it?

Mr. MILLS. I am not sure I understand.

Mr. WALGREN. Let me ask you another question. I guess I am not expressing that one well enough.

Do you feel from the educational community that some programs would have more vitality if they were in the NSF as opposed to the Department of Education?

Mr. MILLS. Yes.

Mr. PETTIT. Could I suggest another criterion that might be useful, too.

I think it is probably fair to say that in terms of performance of the work, neither the NSF nor the DOE would be performing it, but they would be the vehicle through which people out there would be doing the performing.

I would suggest if the people out there who are going to do a part of the program are science and math and engineering people in the universities, then the relationships are more congenial and more comfortable and familiar through the NSF.

That is something of an oversimplification, but if the summer institutes are to be done by university people in math and science in a contract with the university, the NSF would be perhaps preferred.

Mr. PHILLIPS. If I might just add, Mr. Congressman, I think the balance that I mentioned a minute ago between the title I (a) and

(b) of this, which as I understand it flows through the Department of Education, and then title II in NSF, I think that balance is a correct one because I think it has identified, the different elements.

I think the answer to your question is it is spelled out pretty clearly now and is in the right perspective. I am not sure that changing from one to the other would improve it.

Mr. WALGREN. As I understand the bill at this point, we would be putting all the teacher initiatives, all the summer institutes, all the educational research, at least in terms of specified dollar amounts, into the Department of Education.

I guess my question is, is there an energy that would be brought from the local level to these programs on a different level if they were conducted by the NSF as opposed to the Department of Education?

If I might, Mr. Chairman, ask one other question, and I will try to be very brief.

In our traditional approach to the National Science Foundation we basically have let them allocate the program areas in which the money is spent, or to a large degree we have.

Will 2-year and community colleges be substantially left out, and I am thinking particularly of technician training, and I notice, Representative Mills, that you indicate that there should be a reservation of funds for the technician role that we hope community colleges will be able to play?

Could you speak to that?

Mr. MILLS. As a matter of principle, one of the things that I think you are getting at in this bill and that we are attempting to get at is the vocational aspects of the institutions of higher learning.

We want to emphasize that, and it is again interaction with the private sector. I think that is significant to this committee's role in dealing with community colleges and the university systems. We are trying to recognize that as a specific need, as well the whole spectrum.

Mr. WALGREN. But then does that specific need really need a reservation of a portion of these funds, if it is to be adequately addressed, or can that be just one of a host of programs that in this instance the National Science Foundation might direct money towards?

Mr. MILLS. Without a reservation you never know whether that particular aspect will be treated. That is your judgment, but that particular area could be lost in some of the more glamorous shuffle.

Mr. WALGREN. Thank you, Mr. Chairman.

Mr. PETTIT. Could I just add a footnote on that one?

The CHAIRMAN. Yes, Dr. Pettit.

Mr. PETTIT. I think one has a whole scale of kinds of people involved in this total enterprise. I think the national concern is probably different at the different levels.

I have observed—technicians are necessary. No question about that. It doesn't take as long to train a technician. The needs tend to be local. But to train someone at the master's or doctor's level in engineering or science takes a spell of 4 to 8 years. Then those people are very mobile. They will move where the high technology positions are.

I have seen industries train their own technicians. I have seen local communities come to the front when a firm was about to move a high technology lab in there to subsidize that technician kind of training. The response can be quick, it can be effective.

I am just saying that the priorities nationally are probably up at the higher end of the scale and there will be more chance for local participation at the technician level.

The CHAIRMAN. Thank you.

Mr. MacKay.

Mr. MACKAY. The thing I am concerned about in this bill is whether we are putting rigidities into the program that would keep States, knowing the tremendous variation between States and the way they are going about this, historically not necessarily logically, whether we are putting restrictions in here that would keep States from being able to go forward with programs they already have underway.

I certainly agree that the North Carolina approach is excellent. It is one that we have looked at for a long time.

I wonder if you, as people who are trying to administer programs at the State and local level, see that in the bill? That is the only concern I had.

Mr. PHILLIPS. A very quick answer. There are some places where it could be a little more open. I think it basically gets at making major use of it.

Mr. MACKAY. Well, let me give a specific. I read the bill, because of the wording in title I, as saying you can use this money to provide expenses for teachers going in the summer, but I read it as excluding the possibility of providing a stipend.

I thought I understood you to say that you were pushing at the legislative level for year-around, which would be a way to provide a supplemental salary for math and science.

Do you think we can solve this problem without dealing with the fact that the competing uses of these credentials are now paying two to three times as much? That is all I am asking. Should we draft a bill that goes out of here in a way that keeps you from being able to use this money to deal with what the real problem is?

Mr. PHILLIPS. Again, I think you can only provide a part of the total thrust. If that is the thrust that is reflected in this legislation, then the State level leadership will have to find ways to make that fit their total package. I am not sure you can answer all of the needs through the one piece of legislation.

I guess my quickest answer is that this does fit if we are willing to make it fit. That is what you are asking.

Mr. MACKAY. You can work around it, in other words?

Mr. PHILLIPS. Yes.

Mr. MILLS. From our point of view, it is hard to identify where all the inflexibility is in a bill of this kind. We, of course, want as much flexibility as possible to deal with them. The particular issue you talk about is a good example.

We, in terms of differential pay, are not very excited about that as a concept so stated. The issue of year-around occupation and doing additional work we feel could be addressed successfully, and we would want to have the flexibility to use those funds for those purposes.

Mr. MacKay. Thank you, Mr. Chairman.

Mr. **Walgren** [presiding]. Thank you, Mr. MacKay.

Mr. McCurdy.

Mr. McCurdy. Thank you, Mr. Chairman.

Gentlemen, I want to tell you how much I appreciate your testimony this morning and taking your time to help us in this very important legislation.

As I see the problem, as we have stated time and time again, there are three basic problems: one, to attracting qualified people to teach; second, retention; and third, upgrading the current teachers.

I assume that you all would agree with those three basic issues. Do you have a fourth or any other suggestions? Are those the first criteria we have to meet?

If it is, do you see, on the attraction standpoint, that the loan program or scholarship program is adequate and at what level you would recommend—and again, I raise this question because Mr. Goodling—and there is a little debate within the different committees, as to what point in time a scholarship for a person entering into math or science education would be beneficial. I would like to have your input on that question.

Second, I think we have gotten into the question of retention. You talked about pay differential. That is a very difficult issue to address. Again, I think there are different perspectives on how to best address that.

I would like for you to perhaps reiterate how you would best handle that issue. I understand it is a touch issue when it comes to teachers' unions and all these things you are not supposed to talk about in these meetings, but someone has to talk about them. We need to get down to it and say that pay differential is an issue and it is one that has to be addressed.

I would also like to make a quick comment—and I am hitting you with all these questions at once because my time is running, and let you take someone else's time in answering—on the question of languages. We have had it raised, and Mr. Simon is the expert in this area on that particular question.

I would be interested to see if you have any comments. Recently on a trip to Japan we found that it is a one-way street. We have a lot of engineers doing studies over here in engineering and advanced sciences, but we don't have anyone learning from them because very few engineers speak Japanese. Perhaps you have some perspective to that.

I think Dr. Phillips and Dr. Pettit have experience in some of the NSF programs, such as fellowships, traineeships, institutes, course content improvement, research participation in scientific activities for teachers, visiting scientists, special activities, science education for undergraduate students, science education for secondary school students, specialized advanced science education, and instructional equipment for undergraduate education. Those are the basic categories that we have had funding for in the past which have perhaps been neglected in the past few years.

Would you care to list your priorities? Again, we are writing this bill. Now is the time to get the input. When it comes to NSF funding, are there some programs that you would put a higher priority on than others?

I think I have hit the field. I will let you respond and clarify any position.

Mr. PHILLIPS. I will start, and try to do it briefly.

No. 1, there is no single magic answer, as I think we all know. The issue of compensation and attraction to the business of teaching is still related to compensation, no matter how much we say about it. There are other satisfactions, but compensation is still—I think that is an issue we are going to have to confront directly at the State level. I am not sure at the national level you can get into that business of compensation.

I think the focus of everything that deals with this at the national level ought to be on that one improvement and all the options for improvement of the quality and competence in the people who are involved in education. That makes that the prime thrust.

I think it is a part of the answer to your last question, that those things that do reflect directly on a constant growth pattern—in the education world we have not been able to pick up what business and industry has known from the very beginning, that a major investment of one's resources in the constant growth and improvement of personnel is the payoff. I think the answer lies in that one.

There is one other point I would make on it. I haven't gotten to all of your questions, but on the foreign language, I have a strong feeling that that language ought to stay in here if it does nothing more than keep that focus on a terribly important issue that we have not solved yet in this country.

We don't have the problem that the Japanese have because they have chosen their second language without question. They know what it is. The Germans know what that second language is. We are not sure what it is and how to do it, but I think it ought to be in there.

One final quick point that I have to make. Going back to the science and math high school, with all of the pride we have in it and all the things that are happening to kids, we have proved one other point: That if you spend $8,000 or $8,500—and somebody said earlier you just don't do anything by throwing money at it—if you find out when you try it, and the investment in those 400 youngsters of roughly somewhere between $8,000 and $8,500 per pupil has made it possible—we don't have a problem of attracting science and math teachers to that school because the salary is higher, the work conditions are higher, all of the things that are part of the incentive. You don't have the problems of the cost of equipment and materials. They are there.

The message of that is that an adequate investment does pay off if we use it in a cost-effective way.

Thank you.

Mr. MILLS. On the issue of attracting the loan concept, we felt it was elemental. If you don't have people who become interested in becoming teachers, you are not going to be able to develop them later.

I think you made a point earlier, which is also elemental. We want to have someone who is interested in science and math who then becomes interested in becoming a teacher, rather than someone who is perhaps interested in teaching and then looks for a niche in math and science.

There is nothing wrong with physical education teachers. We could use some to improve our football program. But the physical education teacher teaching math and science has been a phenomenon for a number of years. It doesn't work.

I think there really ought to be an emphasis on saying this is someone who wants to be involved in math and science in a creative way, maybe doing different things during their career, maybe being a teacher in primary and secondary schools, maybe being in industry sometime later.

That is fine, after the payback period. We say, the State has backed you, now you back the State through the loan program, I think that is very important.

On the differential pay issue, we have had, as I mentioned to you, in our task force a lot of involvement from the unions and the organizations. Differential pay as a direct concept bothers me as well when you are dealing with primary and secondary teachers.

I have some folks who are math and science teachers who say to me, privately, we don't really think it is a good idea because in the long run, as different issues evolve to be important, then you are going to begin a trading off between disciplines.

A teacher is a teacher, but we have to come up with some way to recognize demand as a factor. The economic demand factor is going to attract people out of teaching, period. So, whether it is the summer program or other involvement with industry, some way to provide the financial incentive to stay in, we have to find it.

I would be very glad to pass that issue on to the Federal level, if we could, but I tend to agree with Dr. Phillips that somehow we are going to have to resolve it. Your assistance would be greatly appreciated. Some money has to be available to accomplish our goal.

I know there will be restrictions involved on language. Coming from a State which is becoming bilingual, we would support any kind of language funding involvement because we think we have to accept bilingualism that as a fact and we have to support it in the long term.

Mr. PETTIT. Could I respond on certain aspects of the question?

First of all, I think that the kinds of questions you raise in connection with that list of various sorts of programs that the NSF has had, and still does have, and which among them would be higher priority, I would say first I believe it would be entirely prudent to let the National Science Foundation do that dividing up. I think that with their advisory apparatus, the National Science Board, and so on, they probably can do it without you having to do it.

In terms of personal biases, let me just go at it this way. I think the greatest leverage on Federal money in this whole operation will be to do those marginal things that will change young people's decisions—what they are going to do tomorrow and next year—without creating any new institutions, any new programs, but simply tip the balance that they go to graduate school, that they stay on for a Ph.D. in computer science or electrical engineering, instead of going to work for IBM or somebody. Or for the one who has the Ph.D., that instead of going into IBM he stays on the faculty and teaches more students coming through the pipeline.

Research initiation kinds of grants that take a young Ph.D. faculty member and give him a chance for summer salaries, equipment, and so on are good. Equipment need is a bottomless pit, but if you tie the equipment grants to research projects, where somebody is there, needing it to work on something specific, that will give you a lot of immediate response.

Then you take the bachelor's graduate. If you can set up, as we did during the Sputnik time and in the fifties, set out some 4-year fellowship programs so he can see his way safely to getting the Ph.D., that will get you immediate response.

The programs are there. You don't need to create any new programs. Tip the balance of the decisionmaking and run right on back down the line.

As to the Japanese, that is an interesting question because I have been watching this closely, too.

The reason we have a lot of Japanese here in graduate programs—and that is where they tend to be—is that we have a very good set of graduate programs in our universities. They have very limited programs. The success and innovation is more in what they do with the highly selective graduates of Tokyo University, for example, after they go to work for Hitachi and others.

If you looked at the situation in the late 19th century and early 20th century, you found that the Americans were going to Germany for postgraduate work and the Germans weren't coming here. That is all right. We were catching up.

I wouldn't worry about that. The problem really is not that we have too many Japanese studying in our graduate programs. We don't have enough Americans studying in them. They are making their decisions to go somewhere else: industry and Government. You can effect that with very high leverage by doing the right things with some Federal money.

Mr. McCurdy. Thank you, Mr. Chairman.

Mr. Pettit. Mr. Chairman, I am going to have a logistical problem. I was talking about matching money from the private sector. In the late afternoon in Atlanta, in my home on the tech campus, a number of corporate people are coming, expecting dinner and drinks. I do need to be there, to catch an airplane. If you will forgive me, I am going to duck out in about 10 or 15 minutes.

The Chairman [presiding]. Yes, we certainly understand. We are running behind. We have another panel before lunch. We do appreciate your being here, and any time you have to excuse yourself please feel free to do so.

Mr. Simon.

Mr. Simon. Thank you very much, Mr. Chairman.

Three brief comments. One is we have an outstanding State superintendent in Illinois, but Craig Phillips is the outstanding State superintendent in this Nation. They started years ago working on foreign languages, years ago working on science and math. We ought to be asking him what he is working on right now, and 10 years from now we will be holding a hearing on it right here in Washington.

Dr. Pettit, I have one question for you and then one other observation.

I am a little concerned, as you are, on this matching grant problem, not so much on the distortion that you talk about, but that there may be States and institutions that are more limited than Georgia and Illinois, that may have even greater needs than our two States or your institution or the institutions in my State.

I guess I come down at the point where when we are only talking about $100 million, and when you divide that out, it is not that much. On the other hand, we are talking about a 5-year program, $500 million.

Do you share any of my concerns that the institutions and States with the greatest needs may not be able to take advantage of this?

Mr. PETTIT. No, I will give a response that sounds elite among the elite. I think we have an immediate problem. I don't think we have time to obligate institutions that are far back. I think there are enough institutions of high quality—and I don't mean a handful, I mean 50 or more—that would make a tremendous national impact if you just got the students into those programs and got them better fitted out with equipment.

I would say in terms of a 1- or 2-year horizon, it may be less of a problem than if you were going to have a different kind of a bill and a different kind of a program that would do institution building over a longer period of time. Then that would really be a worry because the States or the institutions that had the least ability might be the ones that you wanted to foster in some way.

I really would monitor it after a year or so and see what happens, see if it really is preventing your achieving the objectives of the bill, which are to turn this situation around nationally in the shortest possible time and with the greatest amount of leverage.

I would be inclined to wait a year and see what happens. I think you can get a good response with the matching. Over a long period of time I would have much more reservation.

Mr. SIMON. Thank you very much.

You use the word—and that was my other comment—all three of you referred to this elitism. We heard this criticism in the Education and Labor Committee. Of all the criticisms, it seems to me that that is the one that has least validity.

I want an elite—when I go to a concert, I want to hear Isaac Stern. I don't to hear somebody that doesn't know how to play a violin. When I have an eye operation, I want to have an elite operating on my eye, not someone who is just average.

We are going to have to develop an elite in this area of science and math if this Nation is to move ahead.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Mr. Simon.

Mr. Nelson.

Mr. NELSON. Thank you, Mr. Chairman.

I yield to Mr. MacKay.

Mr. MACKAY. I realize this is maybe frustrating to you gentlemen, but I would like to go back to the first section of the bill again.

It seems to me that one of the disparities is that the first section of the bill says take the money and spread it by formula. The second section of the bill says take the money and use some discretion where it will do the most good.

Wouldn't it make a lot more sense, Dr. Phillips, to allow the Department of Education, or someone, to fund some pilot programs that can demonstrate just what you can get? Wouldn't you get a lot more leverage out of that than to take the money and say everybody keep doing what you have been doing, but use just a little bit more and that will solve the problem?

Mr. PHILLIPS. Again, to answer it quickly, I really believe that the flow of the resources as reflected in the title I part of it, if you assume—and you have to assume—the level of planning and progress is diverse across this country—if you assume that there is a pattern in which these resources can become a crucial part—not a large part, and there is no reason to believe that it is going to solve all the problem—I really believe the way it is proposed to flow this way would be better than a specific, categorized approach by the department itself.

I think you have some NIE proposals in here that would do the research, but I believe we have to find those ways in which it can be done better through these resources than to have it decided at the national level through the department itself.

I think I am trying to get at what you are asking. I may not.

Mr. MACKAY. I am not saying that we would dictate. I am saying that we would pick out several approaches that appeared to have high promise and would fund those—I am really asking, what do you see as the leadership role of the Federal Government? Do you see it as spreading a little bit of money and saying boy, we solved that one, or do you see it as saying we would like to encourage the people who are doing it best, which seems to be what we are doing in title II of the bill.

Mr. MILLS. I think I agree with the concept that you can't—with this amount of money, even though it sounds conceptually large, it changes as you go from the State to the national level—you can't do those creative things that are going to provide the teaching methods and provide the way to employ these new methods with that money if you spread it everywhere.

We in Florida did quality improvement programs, eminent scholar programs, which were matching type programs. The evidence was that they went to places that wanted them badly, that generated the private money, that had private sector interest. That was a maximum utilization that we didn't always spread evenly, and it can't.

On the elitist issue, I think it is important to put in the record a reaction to criticisms of elitist.

The new emphasis on math and science and computer education is actually a path to a new equality. There are very few children who may be literate in some senses at 10, but they are probably more capable of being literate in computer languages than many of us at 30, 40, or whatever.

Maybe the strongest statement about computers, math or science is it can be a way out, when there is an emphasis on identifying those talents in kids where it may not otherwise be identified. I think this is a place for affirmative action type programs on these fields.

Mr. PHILLIPS. I will just take one more crack at that one. I am very pleased that you are concerned about the thrust of it.

Let me be specific. If my information is correct, roughly $6.5 million would come to North Carolina out of this legislation.

You are saying with this legislation that that $6.5 million would be used for the training and retraining of people. That is the investment. I think that is the national message.

The categorizing in terms of that which flows to LEA's as compared with SEA's, it is still the message, as I understand this legislation, that it must be spent on training and retraining people.

I think that does, and the $6 million will make a difference in North Carolina in terms of getting it completed. It won't solve our problems. There is a lot we must do and a lot more I think that will have to be done beyond that, but I really believe it can flow better that way and make more impact.

Again, that is if we use it correctly, and that is your ultimate evaluation process.

Mr. NELSON. Mr. Chairman, I would just ask one question.

Assuming this investment is made by the Congress passing some type of this legislation, how many years will it be that we see this investment pay off to turn around the math and science illiteracy?

Mr. PHILLIPS. I will give a quick answer.

I don't know that anybody can define the period of time in which you get results. Education is longitudinal in its measures. I think we can take from the evidence of other efforts of a similar nature the message that it can be done and we can see improvement. We do have evidence of impact of similar kinds of programs.

The other piece—and I just have to say it, Mr. Chairman, and I will do it quickly—in all of our endeavors with legislation at the national level and the State level and with local level decisions, in order to get something done in the way of improvement, we tend to assume that we are starting from scratch and that everything is bad and we have to change.

I hope that you will understand—and this is a fellow who has been in this business for 30 years or more now—that there are some exciting things happening in math and science education. We are not an illiterate citizenry in terms of math and science but we do have one heck of a lot to do.

I hope you won't lose in the whole effort to do it better the fact that there are some things going on not just in one or two places, but all across this country. What we have to do is make it better. I think that is the message of this legislation, for what that is worth.

Mr. NELSON. Well, there are some high-powered educators who would disagree with you on that last statement.

Mr. PHILLIPS. I am not sure I know what high-powered educators are. Would you define that for me?

Mr. NELSON. Well, Mr. Mills would know one, Dr. B. Frank Brown in Florida, who has apparently been working with your group on the math and science.

Mr. PHILLIPS. But he would also tell you that some amazing things have been happening to education at the same time.

The CHAIRMAN. Thank you, Mr. Nelson.

Mr. Boehlert.

Mr. **Boehlert**. Mr. Chairman, I understand when I was out inadvertently that you did address a question—I am concerned, as we look at the summer institute portion of this, that the language is—and I understand it—intentionally flexible, but shouldn't we be a little more specific with language requiring cooperation with the LEA's and the State education agencies and the institutions of higher education?

Mr. **Phillips**. I did speak to this earlier. I would say again yes, I think there ought to be some statutory notice of that required cooperation.

Mr. **Boehlert**. I ask it again because I think it is very important to emphasize this.

Mr. **Phillips**. It is important, very important, and I think it needs to be in the legislation.

Mr. **Boehlert**. Thank you very much, Doctor.

That is all, Mr. Chairman.

The **Chairman**. Let me say to the other panel, we are running behind. It will be our intention, since this has gone on this far, that if we were to recess at around 1, we wouldn't have time to finish with the next panel. So, what we are going to do is take a short recess, until 1, at which time we will take up the higher education council and try to proceed this afternoon.

I want to thank you, Jon Mills, for being here and participating, and you, Dr. Phillips. I think both of you, along with Dr. Pettit, can realize there is a considerable amount of interest in this legislation. I think we share a common goal. How we get there may be some room for discussion, but I think the commonality of our objectives are well-known.

Thank you very much for being here.

The committee will stand in recess until 1 p.m.

[Whereupon, at 12:35 p.m. the committee recessed, to reconvene at 1 p.m., the same day.]

AFTERNOON SESSION

Mr. **Fuqua**. The committee will be in order.

We will resume our hearing that began this morning. I hope we do not get as far behind this afternoon as we did this morning.

We do have—we can start with our witnesses that are present. I notice that I don't think Dr. Handler or Dr. Gant are here yet. We do have Dr. Maryly Peck who is president of Polk Community College in Winter Haven; and Dr. Frances Holland, who is a trustee for Allegheny County Community College in Pittsburgh.

If you can join at the table, we will go ahead and begin with you, Dr. Peck.

We do have Dr. Jon Fuller here, if you will pardon me, sir.

Dr. Holland, we will be pleased to hear from you.

STATEMENTS OF FRANCES HOLLAND, TRUSTEE, ALLEGHENY COUNTY COMMUNITY COLLEGE, PITTSBURGH, PA.; EVELYN HANDLER, PRESIDENT, UNIVERSITY OF NEW HAMPSHIRE, DURHAM, N.H.; JAMES GANT, DEAN, SCHOOL OF EDUCATION, FLORIDA STATE UNIVERSITY; MARYLY PECK, PRESIDENT, POLK COMMUNITY COLLEGE, WINTER HAVEN, FLA.; AND JON FULLER, PRESIDENT, GREAT LAKES COLLEGES ASSOCIATION

Ms. HOLLAND. Thank you.

Mr. Chairman, if my full statement can be printed in the record, I will take a few minutes to summarize.

Mr. FUQUA. Yes, without objection, the full statement will be made part of the record, and you may summarize.

Ms. HOLLAND. Thank you.

Let me introduce myself. I am a lifelong resident of Pittsburgh, Pa. I am an educator by profession, formerly a teacher and counselor and an administrator on a college and university level, and am currently chairman of the county civil service commission, that is Allegheny County, where Pittsburgh is located.

I am here today representing 10,000 trustees of community and junior colleges. My own college is the Community College of Allegheny County, a multicampus institution serving 80,000 students.

I am secretary of the board. The college is deeply committed to retraining and cross-training a substantial number of unemployed persons in our area. My fellow trustees and I are called upon to make decisions involving the future viability of our regions.

Massive layoffs, terminations, and plant closings are painful symptoms of the dramatic changes occurring in the Pittsburgh region. Unfortunately, this condition is not confined to one area, but it spreads across the Nation as American industrial giants are outpaced by foreign producers.

This is an emergency which can produce profound effects on our economic well-being. Mr. Chairman, we believe that the Committee on Science and Technology can revitalize the national skills base and turn the economy around by dealing with the crisis immediately.

H.R. 1310 can and we believe will develop into the most important measure dealing with the crisis that Congress adopts in this session. We respectfully suggest that you take the following steps:

Title I of the bill: Establish a long-range plan to give our unborn children, our preschoolers, elementary and secondary school students, a new, exciting look at science and math. Make it fun. Give them superb teachers. Encourage innovative ways of introducing them to the world of high technology.

This long-range plan will guarantee America's future productivity. While this long-range plan is in the process of implementation, we have another plan that is a crash program.

We recommend that you implement immediately a program to deal with the widespread deficiencies among a large pool of adults, many of whom are either employed in high technology industries who have already lost their jobs, but are easily retrainable.

The Nation's 2-year community colleges have developed capabilities to provide competency-based training leading to both associate degrees in high technology and short-cycle retraining, both meeting the needs of industry.

Many of us are located at strategic locations where these adults can be trained near their homes and near industrial centers. The focus should start with industry itself, with defined job opportunities. Let us turn out the quality personnel that American industry needs: Technicians in microelectronics, laser, robotics, telecommunications, computer technologies, in order to regain the competitive edge in global commerce.

In order to give our 2-year colleges the special talent to begin teaching in these high-tech areas, give us the specialist from industry on a short-term basis to provide intensive, concentrated courses.

Provide incentives to industry who share their scientists, technicians and equipment for this purpose. We have a crying need for state-of-the-art equipment. The new high-tech programing that is already under way at our community colleges would require costly capital expenditures which we cannot afford.

You can provide tax benefits that encourage industry to contribute to both.

Finally, set up two national data banks. One, a data bank of human resources. Use the State bureaus of employment security; know what you have in the way of human skills and potential skills.

Two, set up a bank of national high-tech skill needs, like a dictionary of titles, and that is counselor talk. Let industry tell you, and us, what it does need and it will need in the future.

Three, let the community colleges, where over 50 percent of our college freshmen and sophomores are now enrolled—and those community colleges are also represented very well by two national organizations—let them cross-train workers as quickly as possible with the help of the industries who will make available manpower as adjunct faculty to teach our faculty and to provide high-tech equipment.

I thank you, Mr. Chairman, for this opportunity. We are very pleased with the bill as it is, as long as you take into consideration that there are short-range needs and we are not given the same type of time allotments as title I. Obviously, there is the need for a long-range program to teach our children what fun it is to become involved in science and math.

Thank you.

[The prepared statement of Ms. Holland follows:]

STATEMENT BY FRANCES M. HOLLAND, MEMBER, BOARD OF TRUSTEES, COMMUNITY COLLEGE OF ALLEGHENY COUNTY, PITTSBURGH, PA.

Mr. Chairman, recession is perhaps too simple a term for the economic travail which currently afflicts our country. We are faced with a national crisis in unemployment, in productivity — we feel it acutely in the Pittsburgh area, where we see so much suffering and lost hope in our once proud steel industry. Massive layoffs, terminations and plant closings are painful symptoms of the dramatic structural changes occurring in the Pittsburgh region and across the Nation as American industrial giants are outpaced by foreign producers.

We particularly appreciate the opportunity to testify on this bill, Mr. Chairman, because H.R. 1310 might well develop into the most important measure that this Congress adopts to deal with this crisis. The public works bill on which the Congress and the President are now talking of spending $4 billion or more can provide some tens of thousands of short term jobs — but, unfortunately, it would do little to revitalise the national skills base. We are falling behind, badly behind, our rivals in global economic competition. We are faltering in our ability to capitalise on the technological advances in which our own American research and American industry continue to lead the world, because we cannot meet the demand for quality technicians to staff effectively that research and industrial base. The shortfalls and mismatches in our workforce are a primary factor in both the recession and the larger quality and productivity crisis. These deficiencies in our workforce, unless corrected soon, will have profound permanent effects on the structure of the American economy and our ability as a Nation to be self-sufficient in fields vital to our economic well-being and our national security.

To meet the crisis, a wise Nation would, in our earnest judgment, resolve to spend at least as much on the skills gaps as it may spend on infrastructure repair. Your bill could well be the first step in that direction. As important as the new Job Training Partnership Act is — and we expect it to work better than the Comprehensive Employment and Training Act has worked — it does not provide the focus, the new direction that we see possible in H.R. 1310.

The focus we are talking about would start with industry itself, with defined job opportunities — in other words, turning out the quality personnel that American industry desperately needs through applications of existing technologies such as micro-electronic, laser, robotic, telecommunication, and computer technologies in the emerging high-technologies in order to regain its competitive edge in global commerce.

Unless we make significant increases in the quantity and quality of technicians in these high-technology fields quickly, and by that I mean the next three to five years, our Nation could face long-term economic stagnation, which would obviously have severe implications for our national well-being.

It is the consensus of the Association of Community College Trustees and the American Association of Community and Junior Colleges that the country needs a new national strategy, a policy that better unifies the presently fragmented federal programs on job training and employment into the cohesive development and utilization of the Nation's human capital. And your great Committee — the Committee born of the Sputnik challenge, the first Standing Committee, if recollection serves me correctly, added to the House in this century — has the opportunity in this bill, Mr. Chairman, to point national policy in that direction.

Title I of the bill makes a start in such an assault, by helping our schools to upgrade their science and math teachers. Many of the Nation's community and technical colleges suffer the same dire shortages of instructors in science and math that the secondary schools presently endure. With your permission, Mr. Chairman, we would like to make part of this hearing record for your Committee the testimony that Dr. Nolen M. Ellison, Chancellor of Cuyahoga Community College District of Cleveland, gave before the Committee on Education and Labor on this same legislation. If you will note the first table in his testimony, you will see not only that the community colleges are losing faculty in math and physics, for example, but also that they are plagued by critical, almost universal shortages of instructors for their computer and electronics programs.

Incidentally, we see two things in Title I of the bill we feel ought to be amended. Allowing the Congressional scholarships to go only to college seniors would be a serious mistake; the notion that college students won't choose a teaching career until their last year of college is unfounded. The course requirements for certification in most States are so substantial that the students who want teaching careers must start into their education courses long before their senior year. More important, we believe that good teachers make their career choice as a calling of the spirit, in preference over other rewards; and if you are going to give any program enlarging the pool of qualified instructors in math and science the best odds of success, you are going to have to involve the community colleges, simply because our colleges now have more than half the freshmen and sophomores. Moreover, we serve far more minority students than any other area of higher education, and it will be essential to the success of this program that more minority students be attracted to careers teaching math and science. Eligibility for the scholarships should start with the sophomore year.

As a second refinement, the first line of Section 622(b) should start off, "Not less than 25 percent..." rather than simply "Twenty-five percent..." It would appear the Committee intended it to be a floor. We remember all too painfully the hassles that dragged on for years in Title III of the Higher Education Act over what was a "floor" and what was a "ceiling." It may be possible on this point to simply provide such clarification in the Education and Labor Committee's portion of the committee report on the bill.

Like both the high school systems and the universities, the community colleges are constantly outbid for the best people in their technician, science and math courses by industry, which is just as pressed for such talent as are we. They can afford salaries well above typical teaching pay scales. There just aren't enought qualified people to go around.

The instructor shortages also point up two related needs — state-of-the-art equipment is lacking in some or all technician programs on almost every community college campus; the new high technology programming that is under way in our community colleges requires costly expenditures for state-of-the-art hardware and learning systems; and faculty who instruct these programs are hurting universally for professional in-service development related to this high-technology programming. They can't teach state-of-the-art unless they are equipped with state-of-the-art and unless they are exposed to state-of-the-art applications; and in countless cases, I believe, this is as much the cause of the faculty leaving the teaching field, as is higher pay.

While it is in the obvious self-interest of American producers to have their latest equipment used in the courses that supply their skilled personnel, Congress nevertheless should establish tax benefits that encourage industry to contribute more broadly to both of these needs.

Mr. Chairman, as a trustee of a large community college serving a highly industrialized community that is undergoing a transition in the structure of its economy, I am presently called upon to make budgetary decisions regarding these matters, and it is clear that our existing resources will not allow us to produce the number and quality of technical personnel needed for this reindustrialization that must take place.

In short, Mr. Chairman, the problem is much larger than teacher shortages. We applaud what the Education and Labor Committee has done in Title I; thus we urge that you give Title II another emphasis, focusing on the technician shortages and postsecondary needs, and on the capacity of the National Science Foundation to serve these needs.

The more urgent of these needs are portrayed graphically to you by this postsecondary panel. As for the community and technical colleges, the needs that top the list are three: technician training, with emphasis on strengthening those courses that are directly responsive to the employers' defined needs, including small business as well as advanced industry; acquisition of state-of-the-art equipment for those courses; and professional development for the faculty who instruct those courses.

Naturally, Mr. Chairman, we would like to see your part of the bill formed along the lines of the bill, H.R. 6950, that Representative Walgren and his Science, Research and Technology Subcommittee developed last year, which became Section 9 of your previous bill, H.R. 7130. We would like to see Title II of H.R. 1310 focus on those needs which respond expressly to the technician gap, and on initiatives by which associate degree institutions and the business community work in concert to fill that gap. Such initiatives, which key on the employment developing in the emerging technologies, are our best hope of putting America back to work.

We thank you again for this opportunity to be heard.

Mr. **Fuqua**. Thank you very much, Dr. Holland.

To present our next witness, I would like to call on a member of our committee, and one who has been very interested in this legislation, Congressman Gregg, to present one of his native New Hampshirites.

Mr. **Gregg**. Thank you very much, Mr. Chairman. It is a pleasure for me to present to the committee Dr. Handler, who is president of the University of New Hampshire. She is here representing innumerable other institutions, because they recognize her skill and ability also, and she has been a leader in New Hampshire in drawing attention to this issue of science and math education; developing curriculum and trying to get, especially the elementary and secondary schools, involved in the whole issue of education in the area of science and math.

We have a little bit of regret, however, that she also appears before us probably for the last time as president of the University of New Hampshire. She is moving on to a prestigious position as president of Brandeis University, and it is a great loss to New Hampshire, because she has done dynamic things for us over the last few years as president of the UNH, and we will miss her very much.

But it is a great pleasure to have you here before the committee. Dr. Handler.

Ms. **Handler**. Congressman Gregg, thank you very much, indeed, for that generous introduction.

Mr. Chairman, and members of the committee, I appreciate this opportunity to appear before you to present the views of the higher education community regarding the current crisis in mathematics and science education.

Mr. Chairman, we would like to commend you for the legislative initiative contained in your original bill, H.R. 582, the National Engineering and Science Personnel Act of 1983, and for your role in resolving the jurisdictional dispute that threatened to block the newly proposed legislation.

We are extremely pleased that the present bill under discussion, H.R. 1310, recognizes the Federal responsibility for science education and that it should be shared between the Department of Education and the National Science Foundation.

H.R. 1310 outlines an appropriate role for each agency and begins to outline a comprehensive solution to what is a broad-based problem. We are pleased that you and Chairman Perkins are moving H.R. 1310 forward. Rapid action, all must agree, is needed to begin to prevent further deterioration of our scientific education system.

We must use the current crisis not only to arrest the erosion in our system, but also to build our capacities for the future.

The purpose of my very brief testimony is to share with you a paper entitled, "Higher Education's Agenda in Mathematics, Science and Technology Education," and to acquaint you with the proposals it contains. This agenda was developed as a collaborative effort by the 18 higher education associations that have endorsed the document, and on whose behalf I am speaking.

Together, they represent the Nation's 3,000 2- and 4-year colleges and research universities.

Mr. Chairman, I respectfully request permission to introduce this document into the record, and we have so submitted it to your staff.

Mr. **Fuqua**. Thank you. We will make it a part of the record.

Ms. **Handler**. Let me tell you a little bit about my personal experience in science so that you can put it into context with some of the recommendations which I so wholeheartedly support.

I am a research biologist by training, and taught for 15—oh, it was almost 16 years—at the city university, where I then took on the role of dean of science and mathematics at Hunter College, and was very active in developing new opportunities for all our students, especially minority students who entered under the open admissions program.

Since coming to the University of New Hampshire, I have worked, I think with some diligence, to try to engage the primary and secondary schools in working with the university's faculty to develop better curricula in sciences and mathematics for New Hampshire students.

Toward that end, Commissioner Brunelle, commissioner of education in New Hampshire, and I set up the school and university educational council, which has been attending to this very great need in the State.

It is a State, however, that can make plans, but as Congressman Gregg and others will suggest to you, has certain financial problems. And without the intervention of the Federal Government, we will not be able to put many of the very fine proposals in curriculum development and teacher training into operation.

You have heard, I am sure, over the course of, considerations about this bill, a litany of what is going on in the United States, and, indeed, the Congress has heard about them over the course of many years.

At the end of the 97th Congress and throughout the duration of the 97th Congress, a great variety of bills were introduced, so that nothing that I can say in addition to that will do anything but support it, but I feel compelled to once again indicate to you at least some of the concerns which also affect New Hampshire as they do the other land grant universities and the other universities, private and public, 2- and 4-year, research and otherwise, throughout the country.

We are in a position of teaching students, many of whom have inadequate science and mathematics scores. Those scores have been dropping over the course of 20 years. Throughout the States, there is a serious shortage of qualified mathematics and science teachers.

During the seventies, the number of secondary school mathematics teachers hiring trained declined by 77 percent; science teachers being trained declined by 65 percent. Some 50 percent of the newly employed teachers nationwide currently are uncertified and unqualified to teach mathematics and sciences.

The situation has been exacerbated by the rapid departure of trained classroom teachers for better-paying jobs in industry.

And earlier this morning, the chairman referred to the phrase that is commonly used, "We are eating our seed corn." We recognize it in the higher education establishment, and industry recognizes it more and more every day.

There are, and this is of great concern to me personally, at least 2,000 vacant faculty positions in university engineering departments. Despite what we do at our various engineering schools around the country, these vacancies persist.

In turn, we are training fewer and fewer engineers in relationship to the number of students who apply to our engineering school. We know that at New Hampshire, we can accommodate no more than 25 percent of the eligible and able students who would go into engineering.

A similar percentage is also true in computer sciences.

In talking to Joe Pettit yesterday at the executive meeting of the Land Grant Association, we agreed that this was not either Georgia Tech's problem alone, or New Hampshire's problem alone, but is apparently the case throughout the Nation.

In addition, tens of thousands of technician openings are going begging, even as the national rate of unemployment approaches some 11 percent. The Congressional Budget Office projects that new technologies will make another 3 million more jobs obsolete by the end of this century.

Secondary students are taking fewer courses in math and science than ever before in the past. At the same time—the other problem which was also raised earlier—our greatest competitor, Japan—and it is also true for England, France, Germany, and of course, the Soviet Union, are ever-increasingly stressing the role of science and mathematics education for their young people.

Since 1972, there has been a 54-percent decline in the number of Ph.D.'s awarded in engineering yearly to U.S. nationals. And while, as again was mentioned, Ph.D.'s in engineering awarded to foreign students have more than doubled.

Finally, a statistic which is staggering, Japan, one of our primary competitors in the world marketplace, produces twice as many engineers as we do, even though their population base is half of ours.

From 1970 to 1977, the number of engineers per 1,000 workers increased by 48 percent in Japan, and decreased by 9 percent in the United States. It is not too often that we have the opportunity to bring to your attention these vital and, nevertheless, deeply concerning statistics.

American postsecondary education institutions, therefore, face a unique dilemma with respect to the current crisis in our scientific education system. We are victims of the crisis, and at the same time, we know, we absolutely are certain that we can provide solutions to the declining educational base.

We believe that higher education problems must be addressed so that its resources can be directed toward the most critical aspects that beset the science education system: Training adequate number of qualified mathematics and science school teachers; providing education for science and technology-related careers; encouraging the proper research environment experience and tools to train the next generation of scientists, engineers, and researchers; and finally, conducting research to improve instruction and the educational uses of information technology.

Higher education's agenda in mathematics, science, and technology education suggests a comprehensive set of proposals designed to assist colleges and universities to realize their potential for helping to solve the Nation's science, mathematics, and technology education crisis.

In addressing the broad dimensions of the problem, the agenda incorporates the view of the higher education community that both the Department of Education and the National Science Foundation have important roles to play in supporting a revitalized Federal commitment to science education.

Therefore, the agenda proposes the establishment of five new programs, two to be administered by the Department of Education, and three by the National Science Foundation. We believe that each program is an essential component of the total effort needed in this area, and that H.R. 1310 is consistent with the approach we favor.

For the Department of Education, we propose a grant program for schools, colleges, and universities to encourage the linkage between colleges and universities and the public and private elementary and secondary schools in the improvement of science education.

We also propose, within the Department of Education, a new program administered by the National Institute of Education to strengthen teaching and learning research through grants focused on the identification of successful instruction and the application of cognitive research to improve instructional programs.

For the National Science Foundation, we propose the establishment of a series of new and expanded programs to provide the fellowships, traineeships, summer study support, research incentive awards, and faculty renewal awards needed to increase the production of scientists, engineering faculty, researchers, and science educators and to upgrade the teaching faculty.

We also propose for NSF a new program to improve undergraduate instructional programs and develop the school and college materials for mathematics, science, and technology education.

Finally, at NSF, we propose a two-part program for the acquisition and installation of modern instructional equipment for use in teaching and training for teaching, and for sharing scientific equipment among institutions regionally and between the academic and business sectors.

We believe that the three-part program we advocate for the National Science Foundation could offer useful guidelines for the expenditure of money from the proposed engineering and science personnel fund, outlined in title II of H.R. 1310.

Money from the fund could be used for our proposed program of opportunities for teachers, young scholars, and researchers through expanded fellowships, new traineeships, research incentive awards, and faculty awards for summer study.

Priorities should be given in these programs to faculty development, young engineering awards, and precollege science and mathematics teacher training.

Likewise, the fund could also support our proposal to upgrade and improve instructional programs in math, science, and technology and encourage industries' involvement in this process to upgrade undergraduate instructional equipment, including computer accessibility, and further its utilization. And, it can also strengthen educational research.

We urge this committee to follow the Education and Labor Committee in taking favorable action on H.R. 1310. The coordinated approach and collaborative manner in this legislation will serve as an important first step in the resolution of our current crisis in science education.

We stand ready to work with the committee as you develop the legislation to resolve the current crisis and build long-term solutions.

Thank you very much.

[The prepared statement of Ms. Handler follows:]

TESTIMONY

TO THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U. S. HOUSE OF REPRESENTATIVES

FEBRUARY 16, 1983

GIVEN BY:

DR. EVELYN E. HANDLER
PRESIDENT, UNIVERSITY OF NEW HAMPSHIRE

ON BEHALF OF:

American Association of Colleges for Teacher Education
American Association of Community and Junior Colleges
American Association of State Colleges and Universities
American Council on Education
American Educational Research Association
Association of Affiliated College and University Offices
Association of American Colleges
Association of American Universities
Association of Catholic Colleges and Universities
Association of Jesuit Colleges and Universities
Association of Urban Universities
California State University
Council of Graduate Schools in the United States
Council of Independent Colleges
National Association for Equal Opportunity in Higher Education
National Association of College and University Business Officers
National Association of Independent Colleges and Universities
National Association of Schools and Colleges of the United Methodist Church
National Association of State Universities and Land-Grant Colleges
State University of New York

Mr. Chairman and Members of the Committee:

I appreciate this opportunity to appear before you to present the views of the higher education community regarding the current crisis in mathematics and science education.

Mr. Chairman, we commend you for the legislative initiatives contained in your original bill HR 582, the National Engineering and Science Personnel Act of 1983 and for your role in resolving the jursdictional dispute that threatened to block newly proposed legislation. We are pleased that the present bill under discussion, HR 1310, recognizes that Federal responsibility for science education should be shared between the Department of Education and the National Science Foundation; HR 1310 outlines an appropriate role for each agency and begins to outline an comprehensive solution to what is a broad based problem.

We are pleased that you and Chairman Perkins are moving HR 1310 forward. Rapid action, all must agree, is needed to begin to prevent further deterioration of our scientific education system. We must use the current crisis to not only arrest the erosion in our system but also to build our capacities for the future.

The purpose of my brief testimony is to share with you a paper entitled "Higher Education's Agenda in Mathematics, Science and Technology Education" and to acquaint you with the proposals it contains. This agenda was developed as a collaborative effort by the eighteen higher education associations that have endorsed the document, and on whose behalf I am speaking. Together, they represent the nation's 3,000 two- and four-year colleges and research universities. Mr. Chairman, I respectfully request permission to introduce this document into the record.

America's postsecondary education institutions, face a unique dilemma with respect to the current crisis in our scientific education system: we are victims of this crisis, at the same time that we can provide solutions to the declining educational base.

We believe that higher education's problems must be addressed so that its resources can be directed toward the most critical aspects that beset the science education system -- training adequate numbers of qualified mathematics and science school teachers; providing education for science and technology-related careers; encouraging the proper research environment, experience and tools to train the next generation of scientists, engineers and researchers; and conducting research to improve instruction and the educational uses of information technology.

"Higher Education's Agenda in Mathematics, Science and Technology Education" suggests a comprehensive set of proposals designed to assist colleges and universities realize their potential for helping to solve the nation's science, mathematics and technology education crisis. In addressing the broad dimensions of the problems the Agenda incorporates the view of the higher education community that both the Department of Education and the National Science Foundation have important roles to play in supporting a revitalized federal commitment to science education. Therefore, the Agenda proposes the establishment of five new programs, two to be administered by the Department of Education, and three by the National Science Foundation. We believe that each program is an essential component of the total effort needed in this area and that HR 1310 is consistent with the approach we favor.

For the Department of Education we propose --

a grant program for schools, colleges and universities to encourage the linkage between colleges and universities and public and private elementary and secondary schools in the improvement of science education.

We also propose within the Department of Education --

a new program administered by the National Institute of Education to strengthen teaching and learning research through grants focused on the identification of successful instruction and the application of cognitive research to improved instructional programs.

For the National Science Foundation we propose --

the establishment of a series of new and expanded programs to provide fellowships, traineeships, summer study support, research incentive awards and faculty renewal awards to increase the production of scientists, engineering faculty, researchers and science educators, and to upgrade teaching faculty.

We also propose for the NSF --

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Finally, at NSF, we propose--

a two-part program for the acquisition and installation of modern instructional equipment for use in teaching and training for teaching; and for sharing scientific equipment among institutions regionally and between the academic and business sectors.

We believe that the three part program we advocate for the National Science Foundation could offer useful guidelines for the expenditure of money from the proposed Engineering and Science Personnel Fund outlined in Title II of HR 1310. Monies from the fund could be used for our proposed program of opportunities for teachers, young scholars and researchers through expanded fellowships, new traineeships, research incentive awards and faculty awards for summer study. Priorities should be given within these program to faculty development, young engineering awards and precollege science and mathematics teacher training. Likewise, the fund could also support our proposal to upgrade and improve instructional programs in math, science and technology and encourage industry involvement in this process; upgrade undergraduate instructional equipment, including computer accessibility, and its utilization; and strengthen educational research.

We urge this Committee to follow the Education and Labor Committee in taking favorable action on HR 1310. The coordinated approach and collaborative manner in this legislation will serve as an important first step in the resolution of our current crisis in science education.

We stand ready to work with the Committee as you develop legislation to resolve the current crisis and build for longer-term solutions.

HIGHER EDUCATION'S AGENDA IN MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION

Background

America's productivity, economic welfare and national defense are threatened by the growing crisis in our education system. Awareness of this problem manifested itself during the 97th Congress in numerous legislative proposals, reports of the National Science Board Commission on Precollege Education in Mathematics, Science and Technology, the proliferation of private sector programs, and widespread media attention.

The dimensions of the problem are multifaceted and permeate our educational system from the precollege level to the community college, the undergraduate classrooms and the graduate universities. There is considerable evidence of the decline of our scientific educational system:

- documented declines in student achievement in mathematics and sciences. Average science and mathematics scores on standardized college entrance tests have been dropping steadily for 20 years;

- a serious shortage of qualified mathematics and science teachers. During the 1970's the number of secondary school mathematics teachers being trained declined 77 percent; science teachers being trained declined 65 percent. Some 50 percent of newly employed teachers nationwide are currently uncertified and unqualified to teach mathematics and science. This situation is exacerbated by the rapid departure of trained classroom teachers for better paying jobs in industry;

- at least 2,000 vacant faculty positions in university engineering departments. These vacancies have resulted in enrollment limits which, in turn, impede the training of adequate numbers of B.S. engineers;

- the obsolescence of much of the instrumentation and equipment used in college and university laboratories has been well documented;

- tens of thousands of technician openings are going begging even as the national rate of unemployment approaches 11 percent. The Congressional Budget Office projects that new technologies will make 3 million more jobs obsolete by the end of this century;

- secondary students are taking fewer courses in math and science than in years past, and fewer courses are being offered. Half of all U.S. high school students take no mathematics after the tenth grade, while in other industrialized nations, particularly Japan and Germany, increasing emphasis is being placed on science and mathematics education;

- since 1972 there has been a 54 percent decline in the number of Ph.D.'s awarded in engineering yearly to U.S. nationals, while Ph.D.'s in engineering awarded to foreign students have more than doubled; and

- Japan, one of our primary competitors in the world marketplace, produces twice as many engineers as we do even though their population base is half ours. From 1970 to 1977 the number of engineers per 1,000 workers increased by 48 percent in Japan and decreased by 9 percent in the U.S.

There is bipartisan recognition of this growing crisis. President Reagan, in a message to the 1982 National Academy of Sciences Convocation on Science and Mathematics in the Schools, declared: "The problems today in elementary and secondary school science and mathematics education are serious -- serious enough to compromise America's future ability to develop and advance our traditional industrial base to compete in international marketplaces." The Special Task Force on Long Term Economic Policy of the House Democratic Caucus observed in its report Rebuilding the Road to Opportunity: "in the future, a well-educated, well-trained workforce will be essential to sustained economic growth . . . the future will be won with brainpower . . . The research we must undertake to produce new technologies requires talent -- yet we are not graduating sufficient numbers of scientists, engineers and technicians."

The Federal Role

Although there is now general agreement on the dimensions of the problem, there is no consensus on the solution. The higher education community views the current crisis with alarm. Constructive actions at the institutional, local, state, and national levels are necessary to forestall a further deterioration.

We believe the federal government must play a central role in providing leadership and support for a variety of initiatives outlined in the following pages. Sustained federal investment is required because the problems are national in scope and because failure to resolve them would have grave implications for our national well-being and defense capability. These investments will maximize the return on scarce federal resources, encourage local and individual initiatives, minimize federal control of these efforts, and provide incentives for collaboration among all sectors.

America's postsecondary institutions -- two-year, four-year, and graduate -- all have a major role to play in restoring our economic health and bolstering our national defense. Their resources should be directed to the most critical problems that beset the science education system so that adequate numbers of qualified mathematics and science school teachers will be trained; education for technology and science-related careers will be provided; the proper research environment, experience and tools to train the next generation of scientists, engineers and researchers will be encouraged; and research to improve instruction and the educational uses of information technology will be supported. With such steps students will be sufficiently science-literate to live in an increasingly technological world and have the opportunity to prepare for careers in the sciences; and currently employed teachers, engineers, scientists and researchers will have opportunities to upgrade their skills.

Thus we urge the 98th Congress to enact major legislation that will enable colleges and universities to further fulfill their mission as a vital force in solving the current science, mathematics, and technology education crisis. The higher education community recognizes the interrelationship among all levels of education in resolving the crisis and supports the efforts of the precollege sector to solve their own unique and compelling problems. However, this paper attempts only to address the crisis from the perspectives of higher education.

Proposed Federal Program

The higher education community -- collectively listed at the end of this paper -- supports the establishment of five new programs to be administered by the Department of Education and the National Science Foundation. These programs represent the top priorities of the higher education community regarding science, mathematics and technology education. Each is an essential component of the total effort needed in this area.

For the Department of Education, we propose two programs: a $200 million program for teacher training initiatives to improve science, mathematics and technology education, and a $25 million program to strengthen educational research in these areas.

For the National Science Foundation, we propose three programs: a $100 million program providing opportunities for teachers, young scholars and researchers through expanded graduate fellowships, new traineeships and faculty research awards; a $50 million program to upgrade and improve instructional programs on all levels; and a $200 million program to upgrade instructional equipment and its utilization.

The total $575 million dollar federal investment proposed provides a significant number and variety of new awards to individuals, schools, and colleges. Coupled with local, state and private sector initiatives, these programs will make a substantial contribution toward the revitalization of the science education in the nation.

In embarking on this new federal effort in sciences, math and technology education we must acknowledge the importance of a sustained national commitment to basic research. Without quality research programs, the education enterprise will wither. Our proposal for new federal support of science education should be viewed as an integral part of this commitment. Both research and education are necessary for the economic vitality and defense strength of the U.S. Neither should be funded at the expense of the other.

Title: A Program for Teacher Training Initiatives to Improve Science, Mathematics and Technology Education

Agency:	Department of Education
Authorization:	$200 million
Target:	3,000 grants at up to $200,000 each to schools and colleges

We propose the establishment of a grant program for schools, colleges and universities to be administered by the Department of Education with proposals to be evaluated through a peer review process involving consultation with NSF to identify field readers. The purpose of these grants is to encourage the linkage between colleges and universities and public and private elementary and secondary schools in the improvement of science education. Grants would allow maximum institutional flexibility to be responsive to local needs, and would be awarded according to plans developed by the recipient institution in collaboration with one or more public or private schools or school districts and other appropriate agencies or councils. Priority activities might include, for example:

(1) summer institutes and workshops and a parallel program of inservice education, conducted by higher education institutions across all states and regions to provide practicing teachers and supervisors with up-to-date science and mathematics information and pedagogical concepts;

(2) projects to enhance the capacity of schools and colleges to meet the professional needs of both new and practicing teachers, including faculty development activities; and

(3) support for exemplary state, local and institutional efforts to attract, retain and motivate teachers to pursue careers in precollege mathematics and science education, as well as identification of teacher training projects providing nationally significant examples of campus-based inservice, school site staff development, and the integration of substantive knowledge in mathematics and the sciences with effective teaching strategies, and the dissemination of information about these programs.

Title: A Program to Strengthen Educational Research in Mathematics/Science and Technology Education

Agency: National Institute of Education, in consultation with the National Science Foundation

Authorization: $25 million

Target: New grant competitions for specific research yielding 10 major programmatic awards, and up to 200 individual research grants.

Research on student learning and school and college instruction in math, science, and technology education (particularly focused on secondary schools) is an essential resource for other federal, state and local programs for improving math and science education.

We propose a new program to strengthen teaching and learning research through grants focused on the identification of successful instruction and the application of cognitive research to improved instructional programs. The program will support large scale research competitions dealing with:

(1) research on thinking, teaching and learning related to instruction in math, science and technology;

(2) research on the uses of modern instructional technologies; the status, means of assessment, and selection of instructional software and other mathematics, science and technology education materials;

(3) research on local, state and institutional policies enhancing or inhibiting the recruitment, retention and professional development of school and college math and science faculties; and

(4) research on school, institution and state needs and operations as they relate to the development and support of remedial programs at all levels of education.

Title: A Program of Opportunities for Teachers, Young Scholars and Researchers through Expanded Fellowships, New Traineeships, Research Incentive Awards, and Faculty Awards for Summer Study

Agency: National Science Foundation

Authorization: $100 million

Target: $15 million to expand existing graduate fellowships and to create 600 new graduate fellowships; $15 million for new institutional traineeship programs; $50 million for 1,000 new faculty research incentive awards; $20 million for faculty awards for summer study sabbaticals and special research opportunities.

We propose the establishment of a series of new and expanded programs to provide fellowships, traineeships, summer study support, research incentive awards, and faculty renewal awards to increase the production of scientists, engineering faculty, researchers and science educators, and to upgrade teaching faculty.

Four programs should be supported in this area:

(1) An expanded Graduate Fellowship Program. The structure and effectiveness of the NSF Graduate Fellowship Program, once a premier symbol of the nation's commitment to excellence, has diminished steadily over the years. The NSF fellowship program should be expanded by increasing the number of awards and the amount of the stipend. To achieve this, we propose at least doubling the amount of money available for these fellowships (from $15 million to $30 million) and increasing by approximately one-third both the number and size of the current awards (from 1,400 to 2,000 and at least $15,000 rather than $10,900 per award).

(2) A new $15 million Traineeship Program for science, technology and mathematics educators. Awards of up to $150,000 would be made to colleges and universities. Trainees would be selected by participating departments, schools and institutions from among individuals with demonstrated potential to excel as science, technology and mathematics educators at elementary/secondary and undergraduate levels. Institutions receiving traineeships would gather education specialists and faculty from departments of science, mathematics and technology to create for the trainee a new or improved quality program for preparing the next generation of science educators.

(3) A new $50 million Young Faculty Research Incentive Awards Program. The challenges facing young faculty who seek to establish their first research programs are almost overwhelming. A program offering stable support (averaging $50,000 per year per

award) to assist them in starting academic research careers would help to sustain the quality and flow of individuals into key fields of science, mathematics, engineering and technology. 1,000 awards would be authorized to average $50,000 per year.

(4) A new $20 million program of Faculty Awards for summer study, sabbaticals, and special research opportunities. This program would provide 3,000 awards at $5,000 each for summer support to permit currently employed faculty to take advantage of upgrading opportunities; and a $5 million program for experienced faculty for six- to twelve-month periods at salary equivalent to current levels to: (a) permit revitalization, and experience with new research techniques and advanced research discoveries for those who have been isolated from research institutions and centers for six or more years; and (b) provide for intensive development of teaching techniques and materials in problem areas. A total of $20 million authorized in this area will provide awards on a competitive basis to individuals whose institutions certify that the applicant's principal function is undergraduate teaching in a science-related discipline.

Title: A Program to Upgrade and Improve Instructional Programs in Mathematics, Science and Technology at All Levels

Agency:	National Science Foundation
Authorization:	$50 million
Target:	1,000 instructional improvement projects at up to $200,000 each.

Continuing demands are placed on science educators to keep pace with evolving technological innovations. Updated instructional materials are needed to enhance student motivation and to advance the lagging state of science learning. The need for new instructional materials is particularly acute at the undergraduate level for both general students and science and engineering majors.

We propose a new program to improve undergraduate instructional programs and develop school and college materials for mathematics, science and technology education.

Priority areas include:

(1) restructuring subject matter science courses to reflect state-of-the-art technology and the changing needs of undergraduates;

(2) applying teaching and learning research concepts to the development of mathematics, science and technology instructional materials for schools and colleges; and

(3) stimulating collaborative educational institution/industry efforts in the development of improved programs for schools and colleges.

Title: A Program to Upgrade Undergraduate Instructional Equipment and Its Utilization

Agency: National Science Foundation

Authorization: $200 million

Target: Grants to colleges and universities

The outmoded condition of the instructional equipment in the nation's colleges and universities is well-documented. The absence of state-of-the-art equipment and facilities has immediate consequences in the preparation of today's students, and farreaching implications for the nation's ability to remain scientifically and technologically competitive.

We propose a two-part program for:

(1) acquisition and installation of modern instructional equipment for use in teaching and training for teaching; and

(2) sharing science equipment among institutions regionally and between the academic and business sectors.

We further suggest that a balanced program is needed involving all federal agencies that support research and related education programs to make the acquisition of equipment and renovation of laboratories an allowable component of research proposals.

N. B.: Existing laws and recent legislative proposals have attempted to utilize the mechanism of tax incentives to encourage a corporate response to the science education crisis. We regard these proposals as one aspect of the total effort needed to resolve the urgent problems faced by higher education institutions. These proposals are uniquely well-suited to bringing private sector resources into play. Since this paper addresses only the necessary role of the federal government in the direct provision of support, we have omitted references to these tax incentive proposals.

This proposal is submitted on behalf of the following organizations:

American Association of Colleges for Teacher Education
American Association of Community and Junior Colleges
American Association of State Colleges and Universities
American Council on Education
American Educational Research Association
Association of Affiliated College and University Offices
Association of American Colleges
Association of American Universities
Association of Catholic Colleges and Universities
Association of Jesuit Colleges and Universities
Association of Urban Universities
California State University
Council of Graduate Schools in the United States
Council of Independent Colleges
National Association for Equal Opportunity in Higher Education
National Association of College and University Business Officers
National Association of Independent Colleges and Universities
National Association of Schools and Colleges of the United Methodist Church
National Association of State Universities and Land-Grant Colleges
State University of New York

Mr. SIMON [presiding]. Thank you, Dr. Handler.

Our next witness is Dr. James Gant, the dean of the School of Education of Florida State University, and the chairman of the committee has just been bragging about you to me, Dr. Gant. He is probably going to have more to say after he gets back in.

We are pleased to have you as a witness.

Mr. GANT. Thank you very much.

Mr. Chairman, members of the committee, I am pleased to be with you today to speak on behalf of House bill 1310, as amended and reported.

I would like to commend you and your colleagues in the Education and Labor Committee for your leadership in development and consideration of this legislation. I am from Florida, and wish that I had time to talk to you about all of the things that we have been doing in Florida and how this could relate to that, but I am representing the American Association of Colleges for Teacher Education today, and as the president of that organization, I shall speak from that viewpoint.

AACTE is a voluntary association of colleges and universities dedicated to teacher preparation and renewal. Collectively, our member institutions prepare about 80 percent of all educational personnel graduated annually.

Although AACTE supports all components of the proposal outlined by my colleagues on this panel, I will limit my comments only to those aspects of this legislation specific to teacher preparation.

The attention of the Congress is well directed to search for solutions to shortages of qualified teachers in mathematics, science, technology, and other disciplines. The shortages are real and they are exacting, a toll on our Nation.

The reasons are many. Lack of incentives for young people to enter teaching; status of the profession; remuneration levels; and in some cases, the quality of their preparation and continuing education.

To adequately address these needs will require the cooperation of educators, administrators, citizens, and State, local, and Federal governments. It will require the serious efforts of the higher education community, and my colleagues in elementary and secondary communities.

Reforms may not occur quickly, and they will not be without costs. H.R. 1310 is a beginning. Although a relatively modest bill, dedicated to a specific need, it may be the most significant piece of Federal legislation considered in many years.

It is the policy statement which recognizes the need for scientific and technical literacy for our citizens. It is significant because it is a statement by our Nation that even in difficult times, economic times, the Congress is willing to make education of our children a priority.

It is significant because it is the product of the best efforts of the Committee on Science and Technology and the Committee on Education and Labor.

It is significant because it carries the support of virtually all of the education community.

It is significant because it may point to a departure for all of us to work toward the kinds of long-range reforms needed in our education system. However, because the public's expectations are very high, and because economic realities dictate that Federal investment be modest, it is important that your deliberations result in legislation that will become the foundation for a workable model to execute needed changes, a model that can address current and future teacher shortages in other disciplines.

During my time with you today, I would like to share a few observations of part B of title I.

There can be no argument that we must attract additional bright young people into teaching. I believe financial assistance through scholarships and grants is one of a number of appropriate strategies. Yet I am aware of the debate over the wisdom of expansion of existing loan forgiveness provisions as a recruitment incentive.

We need to ask, will this mechanism work? Is it the most efficient use of limited resources? Will it jeopardize existing student assistance programs?

AACTE supports the national teaching scholarship program described in title I, part B, as a responsible alternative. Nearly half of all students in teacher preparation programs receive some form of Federal assistance: Pell grants, college work study, et cetera.

The attractiveness of the scholarship program is that it will not jeopardize assistance now available to future teachers who may not be selected as national teaching scholars.

I see as a second advantage that the program outlined in H.R. 1310 will allow us 2 years to look at student financial assistance as a recruitment strategy. I believe it is a good idea. I believe that in 2 or 3 years, when you conduct oversight hearings on this act, you will find that it did attract good people into teaching.

I fully expect that we will be back at that time to encourage you and your colleagues on the Education and Labor Committee to examine this strategy as a part of an entire package of student assistance provisions.

The summer institutes authorized under section 624, and administered by the Department of Education, are an excellent delivery mechanism for teacher in service. We particularly support provisions in title I to allow local school districts the flexibility to use grants under part A to support attendance at institutes.

Studies conducted of similar kinds of training activities have shown that when participants are involved in planning and in followup activities, the positive results of the training are dramatically increased.

To enhance the potential of the institutes even further, I would recommend modifying section 624 to include college and university faculty from both the school of education and the departments of mathematics and science in preinstitute and postinstitute activities.

Faculty teams could be brought together with teams of teachers to develop and share faculty and staff development opportunities, to design strategies for teachers and faculty to transport this inservice back to schools and campuses, and to consider recruitment strategies to encourage outstanding high school students to consider careers in teaching.

There are several important concepts in this idea. First, teams of people should be encouraged to attend the institutes. One of the criticisms of similar programs is that when only one individual attended the institute, it became very difficult for that individual to subsequently implement new programs or ideas.

There was no support in the school district for the learnings of the person who had gone off to the institute.

Change is often slow, and is more easily affected by groups of people than by an individual.

Second, the involvement of both schools of education and arts and science faculty and administrators in planning and followup is essential. Teacher inservice should combine both subject matter and technique. The purpose of these institutes is to upgrade teaching, the teaching skills of educational personnel in our elementary and secondary schools.

To conduct institutes that provide only advanced work in mathematics or science has the danger of producing frustrated teachers who are highly skilled in subject matter, but cannot translate it appropriately in a classroom setting.

In those instances, we have found that teachers will leave teaching within the first 3 years.

However, if they have not only the knowledge, but they have the techniques to be able to turn some children on with that knowledge, they get a kind of satisfaction out of being a teacher that will keep them in teaching, even when the working conditions may not be as good as they would like.

These people become a prime candidate. The idea of whether it should be knowledge or teaching is an old idea that does not warrant any additional discussion, as far as I am concerned.

A person can no more teach that which he doesn't know than come back from where he hasn't been. By the same token, one to have great knowledge and not be able to help anybody else with it has useless knowledge. Knowledge is only valuable when it can be used and when it can be transmitted from one person to the other.

It is very frustrating for a person with great knowledge to find out that they can't help somebody else learn. And those people will usually leave the profession.

For many years, collegiate departments of education have worked in close cooperation with local school districts. By identifying schools of education as the coordinating point for these institutes, these existing relationships between schools of education and school districts, and the existing mechanisms can be used to continue and make for a greater program.

Mr. Chairman and members of the committee, on behalf of the schools, colleges, and departments of education located in the institutions of higher education, we urge you to continue your commitment to our Nation's children, schools, and teachers, and to enact legislation that will address the technological needs of our entire education system.

I thank you.

[The prepared statement of Mr. Gant follows:]

STATEMENT BY DR. JAMES L. GANT, PRESIDENT, AMERICAN ASSOCIATION OF COLLEGES FOR TEACHER EDUCATION, DEAN, COLLEGE OF EDUCATION, FLORIDA STATE UNIVERSITY, TALLAHASSEE, FLA.

Mr. Chairman, Members of the Committee. I am pleased to be with you today to speak on behalf of H.R. 1310 as amended and reported, "The Emergency Mathematics, Science and Technology Act". I would like to commend you and your colleagues on the Education and Labor Committee for your leadership in the development and consideration of this legislation.

I am speaking this morning as president of the American Association of Colleges for Teacher Education. AACTE is a voluntary Association of colleges and universities dedicated to teacher preparation and renewal. Collectively our member institutions prepare about 80% of all education personnel graduated annually. Although AACTE supports all components of the proposal outlined by my colleagues on this panel, I will limit my comments only to those aspects of this legislation specific to teacher preparation.

The attention of the Congress is well directed to search for solutions to shortages of qualified teachers in mathematics, science, technology and other disciplines. The shortages are real and they are exacting a toll on our nation. The reasons are many: lack of incentives for young people to enter teaching, status of the profession, remuneration levels, and in some cases the quality of their preparation and continuing education. To adequately address these needs will require the cooperation of educators, administrators, citizens, state, local and federal governments. It will require the serious efforts of the higher education community and my colleagues in the elementary and secondary community. Reforms may not occur quickly and they will not be without cost.

H.R. 1310 is a beginning. Although a relatively modest bill, directed to a specific need, it may be the most significant piece of Federal education legislation considered in many years.

It is significant because it is a statement to our nation that even in difficult economic times, the Congress is willing to make the education of our children a priority.

It is significant because it is the product of the best efforts of the Committee on Science and Technology and the Committee on Education and Labor.

It is significant because it carries the support of virtually all of the education community.

And, it is significant because it may be a point of departure for all of us to work toward the kinds of long range reforms needed in our education system. However, because the public's expectations are very high, and because economic realities dictate that the federal investment must be modest, it is important that your deliberations result in legislation that will become the foundation for a workable model to execute needed changes, a model that can address current and future teacher shortages in other disciplines.

During my time with you today I would like to share a few observations on Part B of Title I.

There can be no argument that we must attract additional bright young people into teaching. I believe financial assistance through scholarships or grants is one of a number of appropriate strategies. Yet, I am aware of debate over the wisdom of expansion of existing loan forgiveness provisions as a recrutiment incentive. We need to ask, will this mechanism work? Is it the most efficient use of limited resources? Will it jeopardize existing student assistance programs? In all honesty, I don't have the answers to these questions. Because we haven't the answers, AACTE supports the National Teaching Scholarship Program described in Title I, part B as a responsible alternative.

Nearly half of all students in teacher preparation programs receive some form of federal financial assistance...Pell Grants, College Work Study, etc. The attractiveness of the scholarship program is that it will not jeopardize assistance now available to future teachers who may not be selected as National Teaching Scholars. I see as a second advantage that the program outlined in H.R. 1310 will allow us two years to look at student financial assistance as a recruitment strategy. I believe it is a good idea; I believe that in two or three years when you conduct oversight hearings on this Act you will find that it did attract good people into teaching; and I fully expect to be back at that time to encourage you and your colleagues on the Education and Labor Committee to examine this strategy as part of an entire package of student assistance provisions.

The Summer Institutes authorized in Sec. 624 (of H.R. 1310 as amended and reported) and administered by the Department of Education are an excellent delivery mechanism for teacher inservice. We particularly support provisions in Title I to allow local school districts the flexibility to use grants under part A to support attendance at the institutes. Studies conducted of similar kinds of training activities have shown that when participants are involved in planning and follow-up activities the positive results of the training are dramatically increased. To enhance the potential of the institutes even further I would recommend modifying Sec. 624 (H.R. 1310 as amended and reported) to include college and university faculty from both the school of education and the departments of mathematics and science in pre-institute and post-institute activities. Faculty teams could be brought together with teams of teachers to develop and share faculty and staff development opportunities, to design strategies for teachers and faculty to transport this inservice back to schools and campuses, and to consider recruitment strategies to encourage outstanding high school students to consider careers in teaching.

There are several important concepts inherent in this idea. First, teams of people should be encouraged to attend the institutes. One of the criticisms I have heard of similar programs is that when only one individual attended from a school or district it became very difficult for the individual to subsequently implement new programs or ideas. Change is often slow, and is more easily effected by groups of people than by individuals.

Second, the involvement of both school of education and arts and sciences faculty and administrators in planning and follow-up is essential. Teacher inservice should combine both subject matter and technique. The purpose of these institutes is to upgrade teaching skills of education personnel in our elementary and secondary schools. To conduct institutes that provide only advanced work in mathematics and science has the danger of producing frustrated teachers who are highly skilled in subject matter, but cannot translate it appropriately into a classroom setting. These people will then become prime candidates to leave the classroom for positions in business and industry.

Third, I would encourage you to specify either in the legislation or through report language that these institutes be coordinated through schools, colleges or departments of education* in cooperation with departments of science and mathematics. For many years collegiate departments of education have worked in close cooperation with local school districts. By identifying schools of education as the coordination point for these institutes, existing relationships can be used.

Mr. Chairman, members of the committee, on behalf of the schools, colleges and departments of education located in institutions of higher education we urge you to continue your commitment to our nation's children, schools, and teachers and to enact legislation that will address the technological needs of our entire education system.

*As defined in Title V, Section 533 (d) of the Higher Education Act of 1965 as amended

Mr. Simon. We thank you, Dr. Gant.

Finally—not finally, two more, I am sorry, Dr. Fuller.

Dr. Maryly—am I pronouncing your first name correct?

Ms. Peck. Yes. Maryly.

Mr. Simon. Maryly Peck, president of Polk Community College in Winter Haven, Fla., and I am advised the first woman college president in the State of Florida.

Ms. Peck. That is correct. Thank you.

Mr. Simon. Pleased to have you with us, Dr. Peck.

Ms. Peck. It is a great pleasure to be here, and I have given a copy of my remarks that I would like entered into the record, please.

Mr. Simon. We will do that. And I might mention that for the other witnesses, too. If you want to just introduce yourself, have your statement entered in the record, and summarize it, that is fine.

Ms. Peck. I am here today to speak for a uniquely American institution, the network of community and technical colleges that are gamely at work trying to meet the challenge of bringing us in America up to our industrial rivals, whose successes have been largely fed by our own technology.

We now find ourselves with severe shortages at every level of the technological spectrum. And most acutely at the technician level.

The community colleges have been working to fill this particular gap. Unfortunately, that capability, that is, of the community colleges and of the technical colleges, up to now has been unrecognized and has not been utilized as the national resource in tackling this challenge that we see before us.

I feel that the community colleges can do a great deal to help you, and that it should be addressed in this particular bill. As a scientist and as an engineer, which I am, I have over 30 years of experience and three degrees in engineering. I have worked in industry and had experience on all levels of education, from the elementary through secondary through the community colleges and the university.

I have often wondered why the National Science Foundation has not taken a deeper interest in the community and technical colleges. The community and technical colleges have grown into the very foundation of postsecondary access. We now represent 50 percent of freshmen and sophomores, not only those that are continuing or stopping out with a career already planned for them, that they can earn a living and fulfill our job market in the technological fields, but also those that can go on and go to the 4-year institutions.

There is more than one path to get to the superior student. I happened to have chosen one which was through the 4-year institution. I did not go directly on to master's degree and Ph.D., I went to work in industry because I feel that kind of experience is very important.

I also feel that this is also true in teaching, as has been pointed out by Mr. Gant; that is, a teacher can be a good teacher, by both methods. I happen to feel that you need to have both kinds of experience, the knowledge and the teaching skills. Teachers can be improved and have been involved in a number of activities that do this.

But it has been an experience of mine that the National Science Foundation has no spokesperson currently on its Board, and very little in the staffing, nor does the Department of Education have but very few senior staff people who speak for the community college system.

We do a great deal in the education field, not only in technician field, but also in those kinds of fields that go on to 4-year degrees, and subsequent graduate work, in the math, science, computer science area.

I would like to point out to you that, if for no other reason, just because of sheer numbers, that you should have some interest in making sure that we are involved in this particular bill's action.

The community colleges have established a great number of what we call employer-specific programs. Those kinds of programs have been already developed in partnership with industry and businesses that happen to be in the community.

The community colleges also stand in the position to work not only with elementary schools and secondary schools, but to provide liaisons on into the universities. We have been required to articulate with both kinds of institutions, and it is our lifeblood to be sure that all the articulation that must go on between the elementary, secondary, and on into the universities, involves the community college transfer-type programs.

I feel that it is very important to our mission, which is to give an access to all kinds of people—we have many, many adults who are coming back into our schools, not only to get a degree which they might never have got, but also to sharpen their skills. There are many people, over a million adults, currently attending the community colleges that are there and who don't even care whether they get credit, but they are back to learn things that they did not learn when they were in school previously.

Our particular country, right now, is faced with improving its technological programs. You will find many of the people who got degrees, even at my age and degree level, did not take all the computer instruction that was necessary, and are coming back now to the community colleges because of its immediate access.

There isn't a university in every community, but there may be far more community colleges there.

The quality and the scope of the technology, science, and math programs that are carried by our community colleges make the 2-year community college a place where you can focus on those kinds of programs. I feel that in the current bill, plus H.R. 582, and with some of the elements of the proposed Walgren bill, we see emerging in H.R. 1310, Mr. Chairman, the seeds of a national strategy which could be aimed at comprehensive development of the Nation's human capital.

I do believe that it is the Nation's human capital that we have to concentrate on, which you are attempting to do in this particular bill.

I can only say to you that I do appreciate much of what you are doing in this bill, and if there have to be some priorities placed upon the bill, that I hope that you will stress the matching pieces of the title II portion of this.

I would like a little flexibility because while we do have, certainly, money enough on the 4-year institutions to perhaps match them, as Dr. Pettit said this morning, it would make it a little easier sometimes to be able to do in-kind matching and not requiring that to be necessarily money.

If we were allowed the flexibility to match it with industry, and giving them the kinds of tax advantages that I think are necessary so that they can give equipment and help us in this matching effort.

I do appreciate your allowing me to speak before you this morning.

[The prepared statement of Ms. Peck follows:]

Statement by Maryly VanLeer Peck, President, Polk Community College, Winter Haven, Fla.

Mr. Chairman, in what has become this Nation's grinding struggle to meet the challenge of our industrial rivals, whose successes have been largely fed by our own technology, we find ourselves hamstrung by severe shortages at every level of the technological spectrum, and most acutely in the technician ranks.

I am here today to speak for a uniquely American institution — the network of community and technical colleges, which are gamely at work trying to meet that challenge, and which have been developing a large measure of the capability the Nation needs to fill its skills gap. Unfortunately, that capability up to now has not been recognized and utilized as a national resource in tackling that challenge.

In the section of H.R. 1310 which this Committee is developing, Mr. Chairman, -- Title II -- we see emerging initiatives by which the capability of this network of colleges can be used to much greater advantage in restoring the Nation's skill base, and overcoming the productivity crisis.

If the country succeeds in regaining its competitive edge in global commerce, that progress will flow in some measure from the skills of the more than four million adults who right now are pursuing technician and other paraprofessional courses in the community colleges. Unfortunately, what we are doing presently is not yet enough. We need your help to meet the larger challenge.

It is wonderful, Mr. Chairman, to see these two great Committees, Science and Technology and Education and Labor, working together as you are on this important legislation. It shows the determination of both Committees and the House leadership to put the national interest first -- and believe me, we appreciate it.

Speaking of the public interest, as a scientist and engineer, I have often wondered why the National Science Foundation has not taken a deeper interest in the community and technical colleges. The community and technical colleges have grown into the very foundation of postsecondary access and learning in this country -- we now have more than 50 percent of the freshmen and sophomores, and we are the one arm of higher education that has maintained a pattern of steady growth in recent years. Yet the 24 member National Science Board, while loaded with university scholars, has no community college voice in its ranks -- and as far as I know, never has had.

Staffing at NSF follows in the same mold. There are virtually no senior staff in the agency that are seasoned in community college work. We might add that the pattern is not much better at the Department of Education. Among the thousands of personnel that ED employs, you can probably count on the fingers of one hand the senior staff who have solid community college backgrounds. It is as if time and reality have passed right by NSF and the Education Department -- and we think that Congress should not permit this in the professional staffing of such pivotal federal agencies. We might add that even though the 1972 Amendments to the Higher Education Act mandated that there would be super-grade representation for community colleges in the U.S. Office of Education, and there would be a community college unit, the letter and spirit of that law has never really been served. The Office of the Director of the Community College Unit at ED has actually gone vacant for many months.

The community colleges will be a pivotal system in any national strategy that revitalizes science and math education in this country, and in overcoming the productivity crisis. Policymakers at every level of government would make a serious oversight not to regard them as such. The simple fact that the two-year colleges have become the largest arm of higher education would be reason enough. But there are other solid reasons. If the Nation succeeds in regaining its competitive edge in the global economy, and I believe it will, the skills of the technicians who are moving through the community college and technical college courses right now will be an important factor. Of the more than five million adults who are presently enrolled in the credit courses and degree programs in the two-year colleges, at least 3.2 million are pursuing technician and occupational courses. There are at least another million adults who are using community colleges to sharpen their career skills who are ignoring formal credit because in most cases they already have higher degrees. In point of fact, community colleges services cut several directions that are vital, beyond the sheer numbers of learners served, in meeting this challenge. Let me stress three:

1. The community colleges already have established great numbers of what we have come to call "employer specific" courses serving the private sector — the very kinds of public-private partnerships that your bill is seeking to foster: the college and local industry working together to solve specific training needs, for both the short term and the long term. And the numbers of such courses are growing every day. As a member of our Governor's newly established State Coordinating Council serving the Job Training Partnership Act, I can assure you that Florida will be working hard to build a lot more of these job-specific training initiatives. The community colleges "employer specific" programs illustrate another of the great advantages of the community college of which I think all of you are aware — the advantage of convenience,

proximity to the learning consumer. This advantage, as much as the advantage of low cost, helps account for the continued growth of the community college.

2. Both the quality and the scope of the technology, science and math programs carried by the community colleges makes the two-year community colleges a bulwark in the struggle to spread technological and computer literacy in our workforce. There's a whole lot of applied science and applied math being taught in the technician courses in the community colleges. Inevitably, some of the gifted learners who start out in technician programs in the community colleges will go on to teach math and science, or later become advanced professionals in industry, who might also serve as adjunct faculty to teach technician programs. The numbers could prove substantial on both counts.

3. By the very nature of their mission, the community colleges have developed broad, working interfaces with both the secondary schools and the senior colleges and universities. They have a pivotal role to play in challenging younger students to study science and technology, and in moving older students into those fields.

With elements from your own bill, H.R. 582, and possible elements from the Walgren bill, we see emerging in H.R. 1310, Mr. Chairman, the seeds of a national strategy aimed at the comprehensive development of the Nation's human capital. It is our conviction, Mr. Chairman, that such a policy should rank just as high on the national agenda as our military capability. We echo what Representative Paul Simon said to this Committee last week, that the key to national security lies in skilled personnel.

Your provision of matching grants could well turn out to be a highly productive approach, provided you specify national needs to be addressed by such grants. Such grants could draw colleges and the business community together in many new initiatives.

Success could well turn on the level of local support you require for eligibility -- we suggest that it should run no higher than 25 percent, and should perhaps be even less in communities suffering the higher levels of industrial unemployment. Perhaps it could be waved entirely for projects in which business and college work together to serve communities with extremely high unemployment. The Northwest timber industry, and the Phosphate and Citrus Industries of my own county in Florida come readily to mind. If the matching grants concept is in fact the program this Committee adopts in Title II, then preference for the grants should be given, we believe, to those institutions whose associate degree programs are producing graduates in the advanced job skills for which there is a real demand.

Even higher preference perhaps should be given to those courses for which an industry itself provides part of the financial match. On such grants, you could be almost sure that the learners were headed into real jobs -- otherwise, industry would not be sharing in the training investment. This was the concept embodied in the bill that Representative George Miller offered last year.

Should you apply such preferences, your Title II might then further specify the types of initiatives that would have priority, such as:

— Cooperative education, in which the trainees gain experience in state-of-the-art applications at the job sites.

— Matches that enable vocational programs to acquire state-of-the-art equipment from the industry.

— Advanced training for faculty in technician and science programs to upgrade their skills.

— Technological literacy, making survey courses in computer systems and other emerging technology available to more adult learners. We are convinced great numbers of adult learners fear the choice of technician careers because they have had no opportunity to acquaint themselves with computers and the emerging technology.

With regard to computer and technological literacy, you might take another look at Section 604(a)(1)(A), which would fund such training for "administrative personnel and for members of local boards of education." If such training is appropriate for local school boards, it is equally appropriate for college boards. But in our view, other priorities should have much higher claim on the limited resources that would be available under this Act.

We see teacher reclamation as a higher priority, for this could be an important step in solving the teacher shortages in math and science. We are losing many very able teachers in other fields because the demand in their fields is diminished. Many of those that want to move into math and science should be retrained to do so. Their teaching skills are a natural resource that should not be abandoned.

Finally, we echo the hope expressed by Dr. Ellison that the two Committees preparing this vital legislation will also call upon the Ways and Means Committee to urge tax reforms that make it easier for industry to help schools and colleges, through gifts of state-of-the-art equipment for occupational programs, as well as through part-time employment for occupational instructors who are staying with their teaching careers, and the use of company professionals as adjunct faculty in such programs.

We thank the Committee again, Mr. Chairman, for your leadership on this legislation and for this hearing.

Mr. **Simon**. Thank you, Dr. Peck.

And our final witness is Dr. Jon Fuller, the president of the Great Lakes Colleges Association. Pleased to have you here.

Mr. **Fuller**. Thank you, Mr. Chairman.

I also would like to ask my prepared statement be inserted in the record, so that I could summarize here.

Mr. **Simon**. It will be.

Mr. **Fuller**. The Great Lakes Colleges Association is a group of 12 liberal arts colleges in Michigan, Indiana, and Ohio, which have chosen, for the last two decades and more, to cooperate to enhance the quality and the effectiveness of their educational programs.

Today, I am representing not only those 12 colleges, but the more than 800 independent colleges and universities that are part of the National Association of Independent Colleges and Universities.

I would like to join my colleagues here in congratulating this committee and the Committee on Education and Labor in picking up this very important topic addressed now in H.R. 1310.

We have neglected this too long. We are going to pay a price for that neglect and, if we neglect it further, we will pay an even higher price.

In addressing the particular role of higher education in these questions of science, education, and training of technical manpower, I want to also endorse the statement which Dr. Handler submitted for the record and summarized in her testimony: The higher education agenda in mathematics, science and technology education. That is a very fine statement of the needs and some of the ways of meeting those needs and of the respective roles of the various components of the educational system and the Federal Government in trying to respond.

In analyzing our problems in science education, it is often easiest to focus on number, on things that we can quantify. We recognize that there are not enough qualified teachers of science, not enough students are taking courses in science, and that students are not taking enough of those courses.

But I would like to suggest that another important part of our problem is a problem of quality. Too many of those who are teaching are not as well trained and up to date as they need to be.

If we are going to have quality science education, we believe strongly that we must involve the practitioners, the scientists themselves, in designing and presenting that education at every level. Active scientists are the people who will know if current and accurate materials are being presented.

I respect Dr. Gant's comments that suggest that you not only have to know the subject, but you also have to know how to present it. It is true that colleges like our own have encountered a good many problems in trying to prepare students particularly for secondary school teaching and for science teaching Some of our colleges, some very fine undergraduate colleges, have had to withdraw altogether from trying to prepare students at that level because of the many requirements in the certification process that emphasize process and method at the expense of content.

We do have to keep a balance there. Certainly a first goal for a teacher of science must be a knowledge of science, and I think part of our problem is this that needs to be said at all.

I know most directly and intimately a dozen independent liberal arts colleges. I know firsthand from our current students and from the record of our graduates that those colleges play an important role in the production of teachers of science and scientists for our society.

I am, therefore, very pleased that the role of undergraduate colleges has just recently been recognized, I think rather belatedly, by the new Director of the NSF, Dr. Knapp. In his budget summary, he put it this way:

> Another critical part of the link in the educational base which provides the Nation's future engineers and scientists is the small, predominately undergraduate college. A significant proportion of those awarded the Ph.D. in science, mathematics and engineering received their baccalaureate at these institutions.

He goes on to note that it is important that faculty at these institutions receive support and encouragement for maintaining their research capabilities.

This hearing on this bill is probably not the most appropriate time to address some of the issues about maintaining that research capability for faculty at undergraduate colleges, but I hope that we might be able to come back when this committee addresses authorizations for the National Science Foundation, where there are programs that appropriately should try to meet that need. I think we have some useful suggestions to make about that.

We believe that the undergraduate years are important. They are a significant part of addressing this problem of science education and the need for trained manpower, because it is during these years that students make their decision to become scientists or teachers of science.

The American Council on Education conducts an annual survey of entering freshmen. One of the disturbing results of those surveys in recent years, confirmed by the most recent one, is that the number interested in teaching has been steadily declining and the number expressing an interest in becoming scientific researchers has been steadily declining.

We believe it is very important that at the undergraduate level, the quality of science and mathematics instruction be just as good as it can be in order to inspire many more of those students to choose those careers.

At the undergraduate level, there are some other needs that I want to at least identify for your consideration. One is that faculty members need regular opportunities to renew their own knowledge, keep up to date in their fields, have some concentrated periods of research. And we hope that some of the provisions of this bill and other programs in the National Science Foundation may be able to address that need.

Second, there is a need in every college and university to bring up to date our equipment for both research and instruction. I gather the provisions about that are still under discussion in this bill. I would suggest that the matching grant concept does represent a very good way to ration scarce resources and to be sure that those needed pieces of equipment go where they are going to be most needed and where they are going to be used to the fullest extent.

Finally, there is a role for assistance with curriculum development at every level, including the undergraduate level, which is needed periodically, particularly in the science and mathematics areas, to keep courses up to date.

These are important issues. We are pleased that this committee is addressing them. We do have a few specific changes which we would like to suggest for the record, if we may, after we have had a chance to study the text of the bill in the next day or two. It has only been available to us in the last day, as you know. If we may have permission to do that, I would like to thank you for this opportunity to appear.

[The prepared statement of Mr. Fuller follows:]

STATEMENT BY PRESIDENT JON FULLER OF THE GREAT LAKES COLLEGES ASSOCIATION, IN BEHALF OF THE NATIONAL ASSOCIATION OF INDEPENDENT COLLEGES AND UNIVERSITIES

Mr. Chairman:

I am pleased to be here today with my higher education colleagues to discuss some of the important issues which are raised by H. R. 1310. I am Jon Fuller, President of the Great Lakes Colleges Association, which consists of twelve independent liberal arts colleges located in Ohio, Michigan, and Indiana.* Today I'm representing not only those twelve colleges but also the more than eight hundred independent colleges and universities which are members of the National Association of Independent Colleges and Universities.

Like my colleagues, I want to congratulate this committee for taking up, in H. R. 1310, some of the important issues concerning the state of science education at all levels in our educational system. These are serious problems. We are already going to pay a high price for having neglected them. We will pay an even higher price if we continue that neglect.

In addressing the particular role of higher education in these issues, I want to endorse the statement which the entire higher education community has developed on "Higher Education's Agenda in Mathematics, Science, and Technology Education." It is a fine statement of the needs we face, the role which higher education should play in responding to those needs, and the appropriate assistance which the federal government should be providing.

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* Those colleges are DePauw, Earlham, and Wabash in Indiana; Albion, Hope, and Kalamazoo in Michigan; and Antioch, Denison, Kenyon, Oberlin, Ohio Wesleyan, and The College of Wooster in Ohio.

In analyzing our problems in science education, it is easiest to focus on the numbers. There are not enough qualified teachers of science. Not enough of our students are taking courses in science and mathematics. They are not taking enough of those courses. But the other part of the problem is quality. Too many of those teaching courses in science and mathematics are not adequately trained to do so and the courses are not demanding enough. If we are to have quality in science education, at every level, it must be designed and presented with the active and central involvement of practitioners, the scientists themselves. Keeping course content current and accurate is an important key to quality, and only active scientists can insure that currency and accuracy.

Better education of teachers of science is an obvious and crucial part of the solution to our urgent problems at the elementary and secondary levels. An unfortunate trend in the training and certification of teachers has been to add more and more course requirements in the process and method of teaching. The goal has been better quality teaching. But the even more important courses in content have been crowded out. Some of the best undergraduate colleges have been forced out of teacher preparation and certification because they have been unwilling to compromise their insistence that the students gain a depth and breadth of knowledge, a requirement that does not leave time for the increasing number of other teacher certification requirements. Knowledge of science must be the first goal for teachers of science. An important clue to the problems we now have in science education is that this needs to be said at all.

I deal most directly and intimately with twelve very good undergraduate colleges. I know from our first hand experience with our current students and from the record of our graduates that those colleges play an important role in providing the scientists and the teachers of science which our society needs for the future. I was therefore very pleased to see in Mr. Knapp's introduction to the National Science Foundation's Budget Summary that he too recognizes the important role of such colleges. As he put it: "Another critical part of the link in the educational base which provides the Nation's future engineers and scientists is the small, predominately undergraduate college. A significant proportion of those awarded the PhD in science, mathematics and engineering receive their baccalaureate at these institutions." He goes on to note that "It is important that faculty of these institutions receive support and encouragement for maintaining their research capabilities." This is not the appropriate time to go into all of the issues about maintaining research capability for faculty at undergraduate colleges. I hope that we will be invited back when this Committee takes up the authorizations for National Science Foundation. I believe that we have, from the experience of our own colleges, some useful suggestions to make about this important part of the total process of science education.

The undergraduate years are when well-prepared students choose and begin their careers as scientists and as teachers of science. As you may know, each year the American Council on Education conducts a survey of entering college freshmen. Among the disturbing findings in these surveys in recent years are that the percentage of entering freshmen who express any interest in teaching careers continues to decline, and that one of the other professional alternatives which shows the steepest decline in interest among freshmen is that of scientific researcher. It is very important that colleges and universities provide excellent instruction in the sciences and in mathematics so that their undergraduate students will be inspired in far greater numbers to choose careers as scientists and as teachers of science.

At the undergraduate level, the other pressing needs which we have identified, in addition to research opportunities for faculty, are:

- regular opportunities for professional renewal for science faculty, enabling them to keep up to date in their fields and to benefit from concentrated periods for research;
- up-to-date equipment, both for research and instruction (we regret that challenge grants to assist with the purchase of equipment for teaching laboratories, which were included in H. R. 30, have been omitted from H. R. 1310; we hope that this important problem will be addressed in other legislation during this session of Congress);
- assistance in curriculum development, which is needed periodically at every institution.

The issues being addressed by H. R. 1310 are important and they are urgent. Unfortunately, what those of us in the higher education panel must remind you of, is that this legislation, with its focus at the elementary and secondary level, addresses only part of our problem and part of our needs. If we are to have a policy which will serve our national interests—providing us with a technically literate citizenry, with well prepared teachers of science, and with an appropriate number of research scientists —more needs to be done. And we hope that there will be another occasion in the near future to talk with the committee about the other parts of this problem.

Mr. SIMON. We thank you very much, Dr. Fuller.

Let me just pick up on one point that you have made for a brief comment, and then yield to my colleagues.

The qualitative question is really very fundamental in all of this. We can measure the quantity problems. It is not only true in the science and technology field, but in higher education in general. We have been talking about access and a lot of other things.

Equally severe is the qualitative problem. How do we maintain and improve the quality that you are talking about? My hope is that this bill at least, to some extent, addresses that problem.

Mr. McCurdy.

Mr. McCURDY. Thank you, Mr. Chairman, and I just would like to echo your comments about our appreciation to the panel for your testimony, and also the input that you have given us.

I think I detected that you detected our bias. There are some problems that we are wrestling with right now as far as some of the questions that have—for instance, in the loan program, I think Dr. Peck probably hit the nail on the head, and I think Dr. Fuller was interested also, and that is, at what point in time, if you are trying to attract a person into math or science teaching profession, do you offer the incentive?

That is an issue that I don't think we have adequately resolved. And I would like to perhaps ask that question again, and maybe get some comments from each of you. It has been stated to me by a number of people, and I think if you were here this morning, Representative Goodling from Pennsylvania, who is the ranking Republican and ranking member on the Education and Labor Committee, indicated he felt that it was only at the junior or senior level maybe at the undergraduate school that you provide that incentive.

I tend to disagree. But perhaps one of you has some statistics or can relate to a study or maybe even your own personal impression as to that question. In particular to education. My point is, and I think some of us have raised it again, we want people interested in math and science to go into teaching as opposed to just people that are interested in education, in teaching, picking up the requisite number of hours for that area that they may be certified in.

Would you care to enter an expression on those areas?

Dr. Handler.

Ms. PECK. I am not sure, because, actually, I think that you can—I guess I want to correct one little point on this thing. I think there is more than one path to get to anything.

I studied to be an engineer and attended to work as an engineer and went to work at the Naval Research Laboratory immediately after my bachelor's degree, with every intention to work forever, I guess, as an engineer.

I got nipped as a part-timer teaching a course, and I love teaching and I go back to it every chance I get. In fact, all my faculty know that all they have to do is ask me to come and talk to a class, and I would be happy to do so.

I do think you need the information. You need to know, have the knowledge, which has certainly been stated to you several times. But I don't think that you should limit yourself just to math and science or engineers, and say that those are the only ones we want to go after, because I know a lot of excellent teachers who started out in, say, social science, and then have later decided that they really did enjoy math themselves, so there are late bloomers even in the teaching profession, if you will.

I feel that the community colleges represent perhaps one of the ways in which we have brought people who did not study to be teachers back into teaching at all levels. We use more part-timers than your traditional universities do, and I was even associated with a traditional university, the University of Maryland, that uses more part-timers in their evening, weekend, overseas programs than probably any school in this country.

So there are ways—and I think the utilization of our people who are active in their fields, who teach part time, can really being a breadth to the classroom that is not represented any other way.

Mr. **McCurdy**. If I might comment, one of our companion bills is a tax credit for high-tech firms to provide some of that incentive. I taught part time in the community college and felt it was one of the greatest experiences I have ever had, and I think it brought something to the institution.

I agree with you totally.

Yes?

Ms. **Handler**. Well, if I could just comment, Congressman McCurdy, I guess I don't disagree with anything that has been said, and certainly, we can retrain teachers who are currently social science or history teachers for mathematics and sciences. But I don't think that was what you were addressing your original question to.

If I could just make a few comments to that. I think I agree with you if you alluded to the notion that a student who comes into college committed to teaching and studying science, or to teach science or mathematics in the high school, should be in a position to be given every option and every help that he can get in terms of financial assistance.

I don't believe that it is necessary to wait until the junior, senior year or the master's year, or at our institution, where we have a 5-year program, to do it in that manner, simply because I think we have a double problem in our midst, if you will.

With information explosion being what it is in sciences and mathematics, and because I agree with Dr. Gant that students should be taught how to teach, as well as the subject matter, students are under the gun in terms of a double pressure.

In the sciences, as even years ago, you know, decades and decades ago, when I went to school, I spent all my afternoon hours in the laboratory while others did not. This prevented me from taking the opportunities at part-time employment that some of my colleagues who were in the humanities and social sciences could take.

In other words, their time is taken up. In order to spur them on, in order to give them incentives, we need to identify them as early as possible. That is not to say that if we identify someone who decides to go into teaching of sciences or mathematics in his junior or senior year, and some students make that transition, that we should not give him assistance at that time.

But I opt for the earliest identification.

There is another comment I would like to make, which I think is very much in line with the identification of teachers, potentially good teachers, potential scientists and so on.

Questions were asked earlier today, how long is this going to take us? Well, it is going to take us a very long time. That is why the multipronged approach that is put forth in H.R. 1310 is so essential. That is why this is not a 1- or 2-year effort. This is an effort of a decade or more.

Because unless we train teachers, retrain teachers, and re-retrain teachers to go back into the elementary schools and excite those children with what is available, not only in the form of technology but adventurous information that they take to as the great adventure.

Children love science. It is our teachers who are afraid to teach it, because they don't know how to. So we must teach them what to teach, and we must teach them how to teach it. Therefore, it is going to be a very long time before we see the full realization of this effort. That is why it is so important to this Nation.

It is an investment in our young people, our greatest resource. I have said that to the members of our educational establishment in New Hampshire. I have said it to the industrial establishment, and I will say it again, and all educators, I think, who are thinking about the future for this country, its economic development, as well as its cultural and historical future, must begin to think about our role as a nation in terms of its young people in this way.

Mr. McCurdy. Thank you, Dr. Handler. I think that is a superb statement. And my time has expired, but I thought Dr. Gant was itching to say something. If not, again, I appreciate your input today.

Ms. Holland. Congressman McCurdy, I am itching to say something, also.

Mr. McCurdy. Good.

Ms. Holland. If you recall, I spoke out the preschooler. It would seem to me that we don't wait until they are in primary school, that we give them every encouragement at the early age in order to turn around the image of that, that perhaps has inadvertently been given to a small child by a parent or a sibling.

Throughout elementary school, it would seem to me, that the incentives could be extra help for any child who shows potential in math and science; in the same way through high school. Certainly, you wouldn't give them a stipend in elementary or secondary school. But as soon as they are ready for higher education, I would think that you could begin your stipends. I don't have the remotest idea when you can finish with those stipends, because it would seem to me that if a young person continues through a community college and then onto a 4-year institution, and became a teacher, he might have to continue that stipend indefinitely.

Mr. Simon. Mr. Gregg.

Mr. Gregg. Thank you very much.

Dr. Handler, to get into some specifics, under this bill, part A, if it gets passed. if it gets authorized, and then if it gets fully appropriated, both of which are pretty slim, especially the appropriation part, New Hampshire would get appoximately $1 million.

How can we best use that limited amount of dollars in a State—using New Hampshire as the example? You say that you have developed a curriculum proposal, that there is the school and university council that has developed some plans, but because of our funding problems we have in New Hampshire, we haven't been able to fund those, how can we best use that money, and what can we, as a——

Ms. **Handler** [continuing]. My belief——

Mr. **Gregg**. Direct it, so that it is best used?

Ms. **Handler**. Well, I do believe that with that limited sum of money, the best approach would be the summer institutes for training of teachers. Whether all of that money should be so directed, I am not entirely convinced, but certainly a good deal of it needs to be directed toward the retraining of our teachers.

Whether it is a team taught effort of pedagogies and subject matter specialists, I think those are areas that we could discuss. But we must do something about making primary and secondary school teachers more comfortable with modern mathematics and modern science, and that is where the great lack is in New Hampshire.

In terms of then the translation of their knowledge and expertise into their particular schools and particular districts, I think that will happen, and needs to happen. Unfortunately, as you know, totally with local funds, as you mentioned earlier this morning, because there is no other way to do it.

There is no State money available for that kind of apparatus, unless someone imposes a strong will on the State legislature. I certainly tried, as you know, in my area, and have not been that successful.

I believe that somehow we also have to identify school children in New Hampshire who are specially gifted in these areas.

Mr. **Gregg**. Do we think we should go to the North Carolina approach of a magnet school?

Ms. **Handler**. I would love to think of that, but I know that setting one up and the funding that needs to come from the State, even through the work with industry, would be a very difficult objective to achieve.

I think you would get a great deal of support from members of the educational community for that kind of pilot project, but I doubt very much that we would get the kind of support from the State legislature that is needed.

Mr. **Gregg**. Do you think the National Science Foundation should run the summer institutions, or the Department of Education?

Ms. **Handler**. I tend to opt for the National Science Foundation, partly, I suppose, the prejudices of my own training, but partly because I think they are proven in this regard. I think the development of the materials, new materials, which are necessary for this kind of instruction need to be at the level of the National Science Foundation.

Ultimately, working with the Department of Education in transmitting that and translating it into pedagogical processes, but I think I opt for the National Science Foundation.

Mr. **Gregg**. I would be interested if anybody else on the panel has a comment on how we use these limited funds, whether you agree with the summer institutes as being the best?

Mr. **Gant**. I think the summer institutes would be an excellent means for use of the resources. But I think the thing that is important is how small resources like this can be used to complement resources and programs that already exist within a particular State, and having the flexibility to be able to use those in association with other forms, the money is too small for it to be a program within itself, but in some way, it has to help with the others.

In terms of the summer institutes and the National Science Foundation, I would come down at a different place unless there was the willingness to go to a team approach that tied the summer institute to the back-home setting.

One of the problems that institutes have experienced in the past is that people go off to an institute and actually learn, but when we go and check to see whether or not that which was learned is used back in the school system, it is not.

We had that experience with institutes like this before. The research that was done on these kinds of institutes showed that people did learn, but they did not use it when they went back into the school system.

The instances wherein it was used when they went back into the school system was when it was planned in the beginning, within the school, what it was that they were going to change when they went to the institute, and there was some kind of followup after they got back in the school system to see whether or not that did occur.

For that reason, I would tend to say that I would rather see the Department of Education that is working with school districts and universities be the one that would do it.

Mr. **Gregg**. Thank you very much.

Thank you, Mr. Chairman.

Mr. **Walgren** [presiding]. Thank you, Mr. Gregg.

I would like to take the opportunity to say how much I appreciate Dr. Holland's being here from my part of the country, and the recognition that that is of the educational and particularly the community college system that we have in our part of the country, and I am reminded, from the statement that Dr. Holland made, that the driving force of this legislation is really the economic crisis and the very immediate economic crisis that we have.

Somehow or other, I am wondering whether the force that will provide the votes for an educational package in both the House and the Senate this year are going to be really addressed by the legislation. And to me, the lack of specificity thus far for community colleges indicates that what is actually going to provide the votes, which is the unemployment that is presently being experienced in the country, may not be the beneficiary of the program.

I wanted to ask, on two points, one on technician training, and in the other, on the community colleges in general, how specifically should we be targeting this money? And particularly, do we need a reservation for community colleges as was suggested by Representative Mills from Florida this morning.

If the community colleges are going to participate adequately in this area, and then particularly, do we need a reservation for technician training in view of the thought that, well, technician training just happens in a very short time frame, and does not need to be driven by any Federal program or any governmental program, but rather, it is automatically driven by the economy or the like.

Could I ask those two points to Dr. Holland, and then ask for comments from the others?

Ms. **Holland**. Congressman Walgren, as you well know, we are in the midst of a dire situation in our area of the country, not just in Pennsylvania, but in all of the adjacent States. In order to utilize our most precious resource, which is manpower, we need a crash program immediately. We can't wait for summer institutes.

The summer institutes can supplement the total program and be an integral part, but we need an ongoing program to train the people who have some background in technical areas and in math and science, but need to be brought up to the needs of industry.

In my remarks, I did say that I thought we needed two data banks, one with a complete inventory of the people who are available, and the other, an inventory of the needs of industry. And we can cross-match them, which doesn't take much time.

Of course, we need to be separated from the total area of training teachers, and of encouraging science at a lower level. Title II is a different ball of wax. I think that not only do you need a special stipend for our program, but it needs to be looked at by an entirely different committee, which is representing Labor Department, Commerce Department, and Department of Education.

Mr. **Walgren**. Other comments on the need for separateness of these programs and for the Congress to put specific dollar amounts on them for the community college and the technician?

Ms. **Peck**. I want to speak to it because I represent a county which has had the dubious distinction of leading the unemployment rate for the State of Florida for the last 12 months. This month was the first month that we ended up in second place instead of first place.

So, we feel a very crucial need, as the Pittsburgh area does, in meeting this particular problem, and the industries from which people have been laid off, these people are good potential employees that can be retrained and they have had an interest in the math and science area.

I am an advocate of lifelong learning, which means that you can move from a technican grade up through the engineering rank, if you will, or up through the science rank and go on into other kinds of fields.

So I would like that opportunity provided. I feel, also, as I said earlier in my remarks, that the National Science Foundation has never had an advocate from the community college ranks. There is no one on their Board. There is no one of senior status that has had any commitment to the community colleges, either from experience or any other thing, and this also holds true for the Department of Education.

There are no senior representatives in the Department of Education as far as their professional personnel is concerned, and not only that, there was supposed to be, within the Office of Education, a community college representative, who was supposed to be a director for that area, and that particular position has stayed vacant now for months.

So I think if you do not specify that there is going to b something for the community colleges, there won't be.

Mr. **Walgren**. Dr. Fuller.

Mr. **Fuller**. Obviously, you are trying to balance long- and short-term goals, and in the issues of science and technology, many of these things are going to take a long time. You are not going to be able to get quick results. But I think it is important to recognize that one of the reasons that we have a problem now is frankly that despite the mandate of its statute and despite the urgings of this committee, the National Science Foundation has not paid much attention to science education and to its mandate to worry about science education.

Despite the encouraging things that the director has been saying about that, I think that unless the committee specifies that certain areas are to be covered, leaving it to the discretion of the National Science Foundation is probably not going to produce the results you want.

Mr. **Walgren**. I appreciate those views.

Mr. Lewis.

Mr. **Lewis**. Thank you, Mr. Chairman.

I have a great concern, Dr. Holland, for faculty flight and piracy, when you get these various instructors trained and things like that, what are you going to do to entice them to stay in teaching rather than jump to the private sector?

Ms. **Holland**. It is a very good question. And I think you might have to provide an incentive. We have been losing faculty regularly, and I don't mean our college solely. This is true all over the country. I hear other trustees talking about this at conventions.

These people like to teach part time for us, in the evening, so that we do provide courses and we have excellent instructors. But to have full-time instructors in math and science, you are going to have to supplement their salaries.

Mr. **Lewis**. Dr. Gant? The quality and quantity of the students today, where we are seeing SAT scores down, how are you going to bring students into the computer sciences, math, and so forth, in an interesting way that they are going to accept the challenge, rather than continue to shy away from it?

Mr. **Gant**. That is a big challenge for all of us, and I think this bill probably might be helpful to us in doing that. We have to, in some way, give teaching back the status it once had, and we all have to get involved in that in some way.

Little things of encouraging people when they are still in junior high school, senior high school, little things of communities having days for teachers, of our looking upon teaching in the kind of way we once did. We all have to be involved in that in some way.

It is true that the workplace may be less attractive, and we are not going to get the brightest students. I don't get the bright, young women into my teacher education program that I once did. Once, they couldn't go anywhere else. The other people wouldn't take them, so I really had me a captive audience there, and should have appreciated that fact. Wish I had that captive audience again, in some ways. Yet, I want them still to have all the opportunities that they now have.

We also had minorities as a sort of a captive audience. We don't have them as captive audiences any more.

So we have to find some way to attract people to teaching for the value that they can get out of that for its intrinsic value. We must attract couples so they can then buy a house. The typical person coming into teaching now has to decide to marry someone who is teaching, or with interest rates as they are, not to expect to live in a house that they would own.

These are basic American ideas that we are talking about here. And I think that we all are going to have to find some way to help people with the esteem value of teaching, and to help them be so successful that they can work in the classroom with young people, see young people grow and value that enough that they can go home and feel good at night.

I think that as we get that going, we will get more young people who are bright who will want to enter because they want to be teachers.

Now, it is true that we do get some very bright young people now they are merit scholars, and they know they can go into any field, and they will decide, "I want to go into education because I want to be a teacher."

That is the kind of person we need in America's classrooms. I think that we can continue to get those. I think this bill will help us in that respect, and I am encouraged by it, really encouraged. I am not discouraged at all.

Mr. LEWIS. Thank you, Mr. Gant.

Thank you, Mr. Chairman, for allowing me to ask questions.

Mr. WALGREN. Thank you, Mr. Lewis.

Mr. MacKay.

Mr. MACKAY. No questions.

Mr. WALGREN. Mr. Nelson.

Mr. Boehlert.

Mr. BOEHLERT. Thank you, Mr. Chairman, I just—Dr. Gant, I am very interested in what you are saying. It is really not, I suppose, a subject for extensive deliberation today, but one of the things that really concerns me is that we expect our teachers to do so many things other than teach, and so that their attention is so oftentimes misdirected; we want them to be monitors; we want them to be chaperones; we want them to be everything that too many of us are too unwilling to be ourselves, disciplinarians.

I am so glad you said what you said, for the record, and it is a subject that I am deeply interested in. We don't think of teachers in terms of scholars when we think of the elementary, secondary level. We just—teachers almost becoming a pejorative today that shouldn't be.

I just hope we will focus more attention on that and I thank you for your remarks, because I just wholeheartedly endorse them.

Thank you, Mr. Chairman.

Mr. WALGREN. Mr. McGrath.

Mr. MCGRATH. I have no questions at this time, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. McGrath.

Other members?

Mr. Fuqua.

Mr. FUQUA [presiding]. I apologize for being out, but I am trying to transact some other business for the committee, and had to step out for a very brief meeting. But I do want to thank the panel, and particularly my good friend, Dr. James Gant, for being here, the dean of the College of Education at Florida State.

But we do appreciate all of our people being here. I think we all share a common goal of trying to move forward in the field of science and math education, and we appreciate your contributions, and thank you all for being here today.

Mr. FUQUA. It is with great reluctance that we call our friend—I am serious, our friend, Congressman Tim Wirth, who is a member of this committee on leave of absence, while he serves on the Budget Committee, and he has worked very closely with this committee in his responsibilities on the Budget Committee, and particularly in the field of science and technology, and Tim, we are very happy to welcome you back to your committee.

STATEMENT OF HON. TIMOTHY E. WIRTH, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF COLORADO

Mr. WIRTH. Thank you very much, Mr. Chairman. I am delighted to be back, and I can assure you that I can hardly wait for my tenure on the Budget Committee to be over.

I would like, if I might, Mr. Chairman, to insert my testimony on H.R. 1310 in the record.

Mr. FUQUA. Without objection, we will make it part of the record.

Mr. WIRTH. Thank you, Mr. Chairman. I would like to make two points related to the legislation, one related to the budget, and one to address some questions that occurred earlier in discussions as to whether this was a realistic initiative.

First of all, I am a cosponsor of this bill, and it seems to me that it is a sound bill. If I had my druthers, I would make two additions to the legislation; one has been suggested by Congressman Simon, which focuses on the foreign area and language training program. This in an area that it is absolutely imperative for us to support particularly in a world of increasing international trade, and I think Congressman Simon, who has continually pushed this, is on the right track.

Second, focusing on the area of university reinstrumentation, there is approximately $50 million authorized in this legislation for university reinstrumentation. It is my belief that that should be a higher figure for two reasons.

One, the basic university infrastructure of laboratories and facilities are having a very difficult time, as you know. They are becoming outmoded. They were built largely in response to Sputnik 20 years ago, and so we have the problem of aging facilities. We also have the problem of dramatically increasing the computer capacity of universities, and I think that that also should be taken into consideration by the committee in marking up the bill.

So it would be my hope that in looking at the legislation you would pay very careful attention to the foreign area and language study program, and to increasing the university reinstrumentation which is funded too low to meet even our current needs, and for which we need further money to meet the computer needs of our universities. I think you have had testimony to that effect this morning.

The final point that I would like to make, if I might, Mr. Chairman, relates to this legislation as it relates to the budget. As the attendance at these hearings demonstrates, there is enormous interest on the Hill in making sure that we respond, as we must, to our Nation's education needs, and that interest has to be reflected in the budget resolution passed by the House and the Senate, and has to be reflected in the appropriations process.

We will have to take those one at a time. I think I can almost assure you that this initiative will be found in the budget resolution coming out of the Budget Committee, going to the floor of the House, and I would not like to be the Members of Congress attempting to take this out once it gets on the floor of the House.

So I think we have a tremendous amount of leverage there. Let's make the package as complete as we can possibly make it, and put it in that budget resolution.

Then we take the next steps of going through the appropriation process and getting this program funded, as it must be. At that point, we will be dealing with the inexorable tradeoffs that we face between a defense budget which has certain emphases in it, a tax program which has other emphases in it, and the investment in our future and in the growth of the economy, which we, as a country, must be making.

Even in these constrained economic times, those investments must be made if we in the United States are going to be able to compete in an increasingly changing world economy.

This is a commitment we all have, and I would suspect that once we get this in the budget resolution and begin to move it, we will have the momentum to fund this program as it must be funded.

With that, Mr. Chairman, I thank you very much. I would be delighted to answer any questions. I suspect you have a very full agenda.

[The prepared statement of Mr. Wirth follows:]

Remarks of Representative Timonthy E. Wirth

Mr. Chairman and Members of the Committee:

I am delighted to be here with you today to express my concern for the plight of our American education system and to express my support for the efforts contained in H.R. 1310. It is a good bill and I urge its passage by this Committee.

I come to you today wearing several hats: as a member of this Committee on leave to serve on the Budget Committee; as Chairman of the Telecommunications Subcommittee; and as chairman of the House Democratic Caucus Task Force on Long-Term Economic Policy. From these vantage points, I would like to share with you my thoughts on some of the critical problems facing our nation's elementary, secondary and postsecondary institutions.

First, it is clear that the quality of education in math and science has been declining. Our schools are suffering a severe shortage of teachers trained to teach these subjects. Studies show that 43 states have a shortage of math teachers at the secondary school level, 42 states show a shortage of physics teachers, and 37 states are experiencing a shortage of chemistry teachers. Indeed, in my own state of Colorado, only 80% of the math slots are being filled by qualified math instructors, and this is expected to decline to 50% by the year 2000.

Students are taking fewer courses in these subject areas than ever before. While overall college entrance exam scores have stabilized after a decline of several years, scores in math and science continue to decline.

At the same time, our economy is moving in a direction which will require an ever increasingly trained workforce. Without corrective action, we will face bleak prospects for long-term economic growth. Moreover, our economy is shifting from one dominated by heavy industry to one dominated by information. The jobs of the future will be open to those who have the necessary training which, without federal assistance will be today's students from the wealthier school districts. Today's students from economically disadvantaged school districts will find themselves shut out of tomorrow's economy without a federal policy which will ensure that funding for skills and training are provided to all.

Second, the environment for economic growth requires a commitment to university research -- yet our university laboratories are starving for new instrumentation. Their equipment is twice as old as industry's, and their students are training on instruments which are already obsolete. Federal investment in universities' R and D plants fell -- in adjusted 1972 dollars -- from over $211 million in 1966 to less than $16 million today.

SUCH NEGLECT IS POUND FOOLISH. THERE IS AN ESTABLISHED RELATION BETWEEN INVESTMENTS IN BASIC RESEARCH AND OUR NATION'S PRODUCTIVITY -- EITHER WITHIN AN INDUSTRY OR ACROSS THE ENTIRE ECONOMY. A UNIVERSITY OF PENNSYLVANIA STUDY SHOWED THAT FULLY 40% OF INCREASED PRODUCTIVITY OVER A 20-YEAR PERIOD IS DUE TO NEW TECHNOLOGY OR INFORMATION. WITHOUT SUBSTANTIAL INCREASES IN FEDERAL SUPPORT FOR R AND D, WE RISK LOSING THE TOOLS THAT WOULD ENABLE US TO INCREASE PRODUCTIVITY GROWTH, JOBS AND ECONOMIC HEALTH IN THE FUTURE.

HEALTHY ECONOMIC GROWTH THROUGHOUT THIS DECADE AND IN THE 1990'S WILL REQUIRE MAJOR NEW INVESTMENTS IN HUMAN CAPITAL THROUGH OUR NATION'S UNIVERSITIES. IT WAS FOR THESE REASONS LAST YEAR THAT I PROPOSED IN THE BUDGET COMMITTEE A MAJOR NEW COMMITMENT TO FEDERAL SUPPORT FOR OUR NATION'S UNIVERSITIES. COMPRISED OF A FIVE YEAR STRATEGY TO RENEW AND INCREASE FEDERAL INVESTMENT IN UNIVERSITY RESEARCH AND DEVELOPMENTS, ITS GOAL WAS TO RESTORE UNIVERSITIES TO THEIR PLACE AS FULL PARTNERS IN THE PURSUIT OF ECONOMIC GROWTH. A SIMILAR GOAL IS REFLECTED IN H.R. 1310.

THIRD, AS CONGRESSMAN SIMON POINTED OUT IN TESTIMONY BEFORE THIS COMMITTEE LAST WEEK, WE MUST NOT LOSE SIGHT OF THE CRITICAL IMPORTANCE INTERNATIONAL EDUCATION WILL PLAY IN OUR FUTURE PRODUCTIVITY AND LONG-TERM ECONOMIC GROWTH. EMPLOYMENT OF ONE IN EVERY SIX AMERICANS IS TIED TO FOREIGN TRADE. $35 BILLION IN EXPORTS (33% OF OUR TOTAL) GOES TO DEVELOPING COUNTRIES.

THIS INTERDEPENDENCE WILL CONTINUE TO EXPAND AS OUR NATION DEVELOPS HIGH TECHNOLOGY PRODUCTS AT AN EVER-GROWING PACE AND TURNS TO INTERNATIONAL TRADE TO MARKET OUR TECHNOLOGY. YET, OUR FEDERAL POLICIES SORELY LACK INITIATIVES IN THIS ARENA. A STUDY DONE BY THE PRESIDENT'S COMMISSION ON FOREIGN LANGUAGES AND INTERNATIONAL STUDIES IN 1979 REPORTED AN ESTIMATED 10,000 ENGLISH-SPEAKING JAPANESE BUSINESS REPRESENTATIVES WERE ON ASSIGNMENT IN THE UNITED STATES. YET, THERE WERE FEWER THAN 900 AMERICAN COUNTERPARTS IN JAPAN, AND ONLY A HANDFUL OF THOSE HAD A WORKING KNOWLEDGE OF JAPANESE. ONLY 8% OF AMERICAN COLLEGES AND UNIVERSITIES REQUIRE A FOREIGN LANGUAGE FOR ADMISSION, COMPARED WITH 34% IN 1966. AND, RATHER THAN INCREASING FUNDING FOR INTERNATIONAL EDUCATION PROGRAMS TO RESPOND TO THESE PROBLEMS, THE ADMINISTRATION HAS PROPOSED TO ELIMINATE ALL FUNDING FOR THESE PROGRAMS. IT IS VITAL THAT WE KEEP THIS IN MIND AS WE ADOPT POLICIES DESIGNED TO TRAIN AMERICA FOR THE FUTURE.

MR. CHAIRMAN, I COMMEND YOU, MR. PERKINS, THE CHAIRMAN OF THE EDUCATION AND LABOR COMMITTEE, AND THE MEMBERS OF BOTH COMMITTEES IN HAVING THE FORESIGHT AND THE DILIGENCE TO DEVELOP A COMPREHENSIVE PROPOSAL DEALING WITH THESE PROBLEMS THAT I HAVE OUTLINED. TITLE I IS WELL SUITED TO CORRECT THE PROBLEMS OUR ELEMENTARY AND SECONDARY SCHOOLS ARE FACING REGARDING MATH AND SCIENCE EDUCATION. ITS GOALS OF IMPROVING IN-SERVICE TEACHER TRAINING IN MATH AND SCIENCE AND OF MODERNIZING OR EXPANDING INSTRUCTIONAL PROGRAMS IN MATH AND science are ones we should all get behind and support. Its initiatives in the higher education area, including the $50 million directed towards university's instrumentation needs and its emphasis on strengthening educational research and development are sorely needed. Finally, the National Science Foundation Engineering and Science Personnel Fund is a significant step towards assuring that our economy is supplied with the trained manpower that is so critically needed. In short, Mr. Chairman, H.R. 1310 is a good response to many of the problems facing America's education. While I would urge the Committee to consider increasing the support for international education and for university instrumentation, I would also strongly urge the Committee to report H.R. 1310 favorably.

Thank you, Mr. Chairman.

Mr. **Fuqua**. Thank you very much, Tim. Yes, we do. And I would like to ask some members, if they could, that we, since we are running about an hour and a half behind schedule, if we could ask only those questions you just feel like, you know, you just can't get by without asking.

I might just point out that you mentioned the part about computer technology, and that is under consideration, adding some language in part B, title II, that would relate to computer science, and I think that suggestion has been made, and it appears to have considerable merit, and I appreciate your support for it.

Mr. **Wirth**. I think it is a very important initiative to be made. I think many of us saw that piece in the Wall Street Journal a couple of weeks ago, which was a good summary of the problems facing our colleges and universities in the training of young people who are hungry for the capability and dealing with the electronic world around us.

Mr. **Nelson**. Would the chairman yield?

Mr. **Fuqua**. Certainly.

Mr. **Nelson**. As I understand it, Mr. Chairman, as part of this jobs package that is now being negotiated that would be a supplemental request in fiscal year 1983, a portion of that is being considered for this math and science education.

Now, the bill that you addressed today is specifically for fiscal year 1984; is that correct?

Mr. **Fuqua**. That is correct. 1984 and 1985.

Mr. **Nelson**. Now, assuming we have that supplemental, we will have something of some momentum to build on.

Mr. **Fuqua**. That is correct.

Mr. NELSON. OK. Very fine.

Mr. FUQUA. If there are no questions, we thank you very much.

Mr. WIRTH. Thank you very much, Mr. Chairman, delighted to be with you. Good luck, and we look forward to shepherding this through the Budget Committee with your help, and Mr. Nelson will be working as well on this, and we will be going from there to appropriations.

Thank you very much.

Mr. FUQUA. I am sure between the two of you, we will get it to the Budget Committee without any problems.

Mr. WIRTH. If there are any problems, talk to Congressman Nelson or me.

Mr. FUQUA. Thank you very much.

Our next panel, the computer accessibility and instructional research, we are pleased to have Mr. Robert Gillespie, vice provost for computing at the University of Washington in Seattle; Dr. Richard Van Horn, a provost at Carnegie-Mellon University in Pittsburgh; and Dr. David H. Florio, director of Government and professional liaison, American Educational Research Association.

Mr. Gillespie, we would be pleased for you to begin, and if either of you three have prepared statements, if you wish to enter them in the record, we will make that, without objection, make that a part of the record, and if you wish to summarize, good.

I apologize for having to keep you over so long, and I realize that other members have other transportation requirements that they must meet, and we will try to hurry this along, so that you can meet those commitments that you have.

Thank you for being here.

STATEMENTS OF ROBERT GILLESPIE, VICE PROVOST FOR COMPUTING, UNIVERSITY OF WASHINGTON, SEATTLE, WASH.; RICHARD VAN HORN, PROVOST, CARNEGIE-MELLON UNIVERSITY, PITTSBURGH, PA.; AND DAVID H. FLORIO, DIRECTOR, GOVERNMENT AND PROFESSIONAL LIAISON, AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

Mr. GILLESPIE. Thank you, Mr. Chairman. I appreciate the opportunity to come. I have some prepared testimony I would like to submit, and I would like to make just a few remarks to summarize the major points.

I strongly support the development of the bill. This bill addresses some of the issues that are confronting us while we attack the problems of the country; particularly in supplying the kind of people that we are going to need. The nature of our industrial activities is changing, and as we move more and more from activities that have been primarily in the manufacturing areas to more information-based activities.

I would like to make two points about the area dealing with computer accessibility and in particular, with title II of the bill on the national engineering and scientific personnel fund, which is aimed at the National Science Foundation's administration.

The first point, is that any expansion of our scientific, engineering, and technical manpower, means that we must significantly increase our access to computer activities.

Our computer activities have changed radically over the years since I became involved with computers over 27 years ago. At that time, I kept my lunch in the computer, and I would say today that I could bring my computer in my lunch. That is part of the shift in that 27 years.

Another part of the shift is the nature and ages of the students, not only in high school, but prehigh school and preschool. Students are acquiring computer knowledge through their parents, through the schools, and through others. And we in higher education are also pressed from the other end of that nutcracker, from those in the professions and those in business who would like to have our graduates, not only in the scientific fields, but in all fields, have some understanding of the computer as a tool.

The second point I would like to make is that the problem is of large scale. Over about a year and a half ago, I completed for the National Science Foundation, a report which identified the national issues connected with computing and higher education. That report was titled, "Computing and Higher Education: An Accidential Revolution."

I titled it that way because I felt that was part of what was happening to us. We were seeing a sweeping change that was affecting the universities and colleges.

The size of the problem is approximately a $1 billion, in terms of providing the level of access that we need to students in higher education. That is, the difference between what we seem to be able to afford and have been spending today, and what we are going to have to spend to respond to the growth. This will require a tripling or more of what we are currently spending on computing, instruction and support of faculty.

Now, that is a large problem, and what I would like to explore are opportunities to attack this problem effectively. I reviewed some of the past programs of the National Science Foundation and found an approach that was very effective in the early sixties, in helping to provide the first wave of computers in our universities and colleges.

The National Science Foundation invested around $70 million for the multinational program, and by its conclusion over $250 million had been invested on the part of the universities, colleges, and States.

So there was a very good indication of the effectiveness of the investment, and showing a priority on the issues of computing. I would like to suggest you could use that program as a model for addressing some of the issues today.

I don't expect the Federal Government to solve the billion-dollar gap. I believe the Federal Government can exert leadership in identifying the priorities on the issues, stimulating the activities, through using the matching program used in the past as a model.

I believe there are two elements that need to be considered: One, the programs and the planning have to be done on a university campus as an institutional plan; second, the matching elements need to insure that there are opportunities to match in kind, as well as in dollars.

For instance, on our campus, when I talk about computer access, I do not mean just buying large computers or buying small computers; I mean supporting the service facilities that we need. You can't train engineers to reengineer the country if they don't have microprocessors to use in their laboratories.

You can't train aerodynamicists and others to use computer-aided design techniques if they don't have access to the kinds of software and the kinds of graphics facilities they need.

It doesn't always mean that we have to have all of those facilities at the university. We happen, by the way, to have worked out arrangements with the Boeing Co. to use certain of their fairly expensive software at hours when their engineering staff is not using the facilities.

That gives a good leverage, and it is quite an important element to us, because we could not afford to provide for a few students, the kind of capability for training that is expected by the Boeing Co. and others when they are looking for engineers.

In talking to people at GE and other industries. I found they were concerned with the amount of training that they felt they had to provide to many of the graduates of the engineering schools. The students did not have the kind of access to the tools they need for their education.

I think, and there can be an accountability for the result. We would like to address the issues and see how we can respond to these demands for change in introduction to computing, and we can measure that, not by counting the number of computers we buy, but by looking at the number of students who are trained and how those results change.

In summary then, I would like to suggest that the matching elements be considered for this important area, and that this bill would provide an opportunity for addressing those effectively.

Thank you.

[The prepared statement of Mr. Gillespie follows:]

ROBERT G. GILLESPIE

VICE PROVOST FOR COMPUTING
LECTURER, COMPUTER SCIENCE DEPARTMENT

UNIVERSITY OF WASHINGTON

Mr. Gillespie graduated in 1955 from Reed College in Portland, Oregon with a B.A. in mathematics (writing a thesis on Sequential Machines). He joined Convair Astronautics where he worked with the early vacuum tube computers, programming, designing analog/digital systems and guidance systems. He then joined the Boeing Company where he was responsible for systems, evaluation of computers, and software research activities. After working at Control Data Corporation where he was responsible for the software research and development department he rejoined the Boeing Company to direct research in CAD applications, software engineering and systems. In 1969 he joined the University of Washington as Director of the Academic Computing Center. Currently he is Vice Provost for Computing where his responsibilities include academic computing, budget and planning for the overall management of computing at the university and liaison with the state government with respect to computing.

He has been Chairman of the EDUCOM Council twice, is chairman of the board of the Washington State Higher Educational Computing Consortium, was one of the founders of the Snowmass conference for Academic Computer Center Directors. He has been active advising and consulting in the U.S. and South America on issues of management and organization of computing facilities and computing and higher education. He is the author of a study for the National Science Foundation: Computing in Higher Education: An Accidental Revolution. He has been interested in the issues of national information policy and participated in the development of the recent bill (H.R.3137) introduced by Congressman George Brown which suggests an national approach.

TESTIMONY

Submitted by

Robert G. Gillespie
Vice Provost for Computing
University of Washington
Seattle, Washington

After growing wildly for years, the field of computing now appears to be reaching its infancy." Pierce Report (to the President's Science Advisor) 1967

I strongly support the objectives of the National Engineering Personnel Act of 1983. The transformation of our economy from farming and manufacturing to one which is based on information and knowledge has been rapid. Investments in education and research, to develop our human capital resources, will be critical in maintaining our economy and security.

In my comments I would like to address one factor that will be important as we plan on increasing the number of engineers, technicians, and scientists. That factor is the ability of our institutions of higher education to provide sufficient computing resources to support the goals of growth.

Higher education is caught between the rising expectations of professions and employers that graduates in all fields will have computer skills, and the increasing expectations of students arriving with skills (and personal computers). Recently, in response to a question about whether high schools and colleges were preparing students to meet the information explosion, Richard Pryor, President of ITT World Communications, Inc. said:

> "As a matter of fact, this educational process is starting out in the home more than any place else and this is forcing the schools to follow suit. There are so many people with youngsters buying home computers today that they are challenging the educational system to catch up. I have seen many smart little home programmers, 14 or 15 years old--these are the people who are going to handle this revolution in the future. Unfortunately they are 10 to 15 years away. It is the near term that I worry about. We have to find people who are equipped to handle the enormous changes we face over just the next few years."

Computing resources refers to the instructors who know how to use computers, curriculums which includes their use and networks to move information on and off campus, as well as the computers, terminals, microprocessors, and personal computers.

You can't teach engineers how to reengineer the world using microprocessors unless they have microprocessors to use in their engineering laboratories. You can't teach students to program unless they have terminals or personal computers. You can't learn to simulate air flow as an aerodynamicist if you don't have access to computer services. You can't learn the use of computer aided design (CAD) techniques unless the software is available. If you want to teach students to write well, then the English departments will need to revamp composition courses to take advantage of wordprocessing.

Recent articles in the Wall Street Journal (January 14, 1983) and the Washington Post (December 28, 1982) point out that U.S. colleges and universities cannot accommodate the masses of students who want to learn to use computers.

In 1981 I completed a study for the National Science Foundation Computers and Higher Education: An Accidental Revolution. The primary findings of that study were:

- Other nations are developing highly integrated plans for accelerating their transition to information-based economies through joint efforts of industry, government, and education.
- Increased productivity and trade will be closely linked to our ability to use the results of new developments in microelectronics, computing and communications.
- The United States faces a critical shortage of people educated to use these new tools, and in turn, higher education faces sever resources problems (faculty and facilities) in responding to these national needs.
- Concern for these issues, and support for the development of strategies to improve our national position, have been shown by those in industry, government, and education.

While it might appear that large sums are now being spent on computing in higher education--more than $1.3 billion per year--over half of these expenditures is for administrative use, not for teaching and research. The current resources provide fewer than ten hours of computer access per student per year. If we increase the number of students using computers we will need to increase our investment. To meet the increased needs for access at least 20 to 40 hours per year will be required for the average undergraduate student (with more required for graduate programs and research). Leading edge institutions, such as Carnegie-Mellon and Dartmouth, are now providing between 40 and 100 hours per student per year.

Access means more than purchasing computers. It means training instructors, developing and using software, building communication facilities, deciding on strategies for incorporating effective use of computers ranging from micro's and personal computers to mini's to supercomputers. Each campus has different goals, different needs, and different strategies.

To address the needs for access would require tripling our investments, increasing the amount spent on computing in instruction from $300 million to $1 billion or more. Essentially, we would need to spend at least as much money for computing as we spend on libraries--about $100 per student.

I don't want or expect the Federal government to solve the whole problem; however it can provide the stimulus and leadership necessary to direct attention and resources to the issue. Each campus needs to be stimulated to devise its strategy and involve the communities that it supports--the students, the faculty, the alumni, the state, and industry.

The American philosopher, George Santyana, said that those who fail to study the past are doomed to repeat it. I would like to comment on a past strategy that I think will yield some ideas for new national approaches. The programs administered by NSF between 1956 and 1965 which provided institutional grants to 184 colleges and universities for acquiring computer resources were very successful. One result of these programs was that the $70 million invested by NSF yielded (through matching funds) a total investment of over $250 million. In addition, the basic objective, stimulating American science by providing access to the new tools, computers, was achieved. The Institutional Computing Services Program, with its requirements for demonstration of,

a) academic needs for research and instructional computing,
b) management capability to administer the resources, and
c) a financial plan

was particularly effective. The institutions were able to establish computing resources on campus which accommodated the requirements of students and researchers in many disciplines.

Later programs addressed networks and stimulated creative resource sharing by universities.

To support the objectives of HR1310 I would recommend that funds be added to the budget of the National Science Foundation to administer a program for stimulating the necessary growth in higher education computing resources. Since the scale of the problem to be resolved is on the order of a billion dollars, the stimulus needed to provide a national impact would be about two hundred million dollars.

To ensure that the various parties involved share the development of these resources, the matching program should:

1. Require the institutions to develop their own assessments of their needs and appropriate plans for resources;
2. Provide incentives for industry and state participation by including equipment donations, loans, and other support as a part of the matching;
3. Ensure there is an accounting of the impact of the programs on institutions, research, and access.

In summary, this approach will:

--draw on a successful Federal program;
--use the experience and responsibility for leadership of the National Science Foundation;
--provide an incentive for cooperation between universities and colleges, industry and the states;
--support the goals expressed in the National Engineering and Scientific Personnel Act of 1983.

This is an approach that can close the gap and address the accidental revolution.

Mr. FUQUA. Thank you very much, Mr. Gillespie.

Mr. Van Horn.

Mr. VAN HORN. There are times in history when significant events happen. It is important to try to understand and recognize when events are happening that really do have national significance, and it is important to take appropriate action with regard to these events at the time they are happening, or slightly before they are happening.

Most of the time, we end up taking action long after something happened. For example, we have had ample time to recognize that there is a shortage of engineering and science students. I think it is an important problem, but it would be equally sensible to try to understand what is the next problem, and to react to the next problem now.

I think there is an extraordinary change coming about in computing that is easy to describe. Up to this current time, computing has been supplied by large machines to a small group of specialists.

Clearly, the change we are going to see over the next 10 years, and certainly over the next 20 years, is computing will be supplied by small machines connected to local and national networks, and those small machines will be used by a large segment of our society, by most professionals, certainly by scientists and engineers, but also by politicians and a large number of other people, ranging from physicians to accountants. Computing is going to be universal in our society.

The universal nature of computing is an important consideration, because it relates to a prime item on the national agenda, is productivity.

We have seen, of course, real changes in productivity of blue-collar workers. What we now are going to see is real changes in the productivity of white-collar workers. Note that if our engineers and scientists were two or three times as effective as they are today, the problem of training scientists and engineers would be much smaller than it is.

There are two pieces to this problem. You can train more people or you can take the people that you have and make them more effective. I would like to suggest that the kinds of changes that are occurring—the movement to provide elaborate computing support to individuals to enhance their own intellectual abilities—will have a dramatic effect on productivity in a number of professional areas.

I don't think this change is speculation. We see a lot of evidence that this change already is happening.

When universal computing happens, the countries or the nations that are able to take advantage of it clearly will have a substantial advantage, not only for themselves, but for society. Countries that capitalize on this development will help our entire society as well as themselves.

The key question is how the United States might gain and hold a leadership position. And I think here, history suggests that universities will play a key role. Universities train professionals, and universities have been the center for many of the innovations that have later been disseminated out into business, industry, Government, and other areas of our society.

We want to educate graduates who are computer competent. Competence is more our goal than just computer literacy. You don't want people who understand what a computer is, you want people who know how to use computers effectively to increase their own productivity. And those are different goals.

If we are going to have computer-competent students, it requires at least three things: Technology, meaningful, educational, and research applications, and adequate funds, plus a commitment on the part of universities to go ahead with such a program.

The work on the technology is going well. There is no problem there. I might note, for example, that my university, Carnegie-Mellon, recently announced a multimillion-dollar project with IBM, a joint partnership to develop a next-generation technology for distributed computing.

A number of major foundations have shown interest in helping with educational and research applications. And again, the Carnegie Corp. of New York just committed over $1 million to Carnegie-Mellon University and a group of other leading universities toward this task.

We certainly welcome help from the National Science Foundation or anyone else, but, I think the development of educational applications is an area that universities can deal with.

The critical issue is how universities move into this new computing environment, and again, I would like to suggest that it is important to our society that universities do move.

Universities have spent a lot of money getting to the kind of environments that we have today; some of which are very good, but most universities will have to move over the next 5 years into the new environments.

Our estimates are that a university that wanted a modest environment might spend approximately $1,000 per student, a small liberal arts college, for example, in investment. For an institution such as Carnegie-Mellon University, with a strong science and engineering orientation, our best estimate is we will have to spend approximately $5,000 per student in investment. That is an investment for us of over $20 million over the next 5 years. That is an enormous amount of capital investment.

We feel that we have to make the investment if we are going to serve the needs of the society.

A program of Federal matching grants for computing equipment at universities would be an extremely good incentive to encourage universities to commit their own funds and to encourage universities to move in this direction.

It is easy to sit back and say universities don't have to do anything, we can wait another 10 or 15 years. However, I think it is important that universities move, that they make this decision, that they make the commitment, and that they provide leadership for society.

Thank you.

[The prepared statement of Mr. Van Horn follows:]

STATEMENT BY RICHARD L. VAN HORN, PROVOST, CARNEGIE-MELLON UNIVERSITY, PITTSBURGH, PA.

Although computing has wrought substantial changes in our society since its birth in 1950, the impact expected in the next twenty years far exceeds any in the past. We truly can expect a "revolution" in the sense that the changes (1) will affect a large group -- most white collar employees including virtually all professionals, (2) will change a large part of the daily lives of each professional and (3) will have a major impact on the economic and political strength of the United States. This coming revolution has critical implications for higher education and for national policy.

These changes will result from a fundamental change in the nature of computing. For the past thirty years, the dominant form of computing activity has depended on specialists with an in-depth knowledge of computing using relatively large and expensive computers. This form of computing has proved useful if not invaluable to our national welfare. In the future, the dominant form of computing activity will depend on computing novices -- ordinary accountants, managers, politicians, physicians, engineers, scientists and secretaries -- using powerful but inexpensive personal computers linked by high-speed communications to local and national information networks. Such a view represents, not idle speculation, but a simple, straightforward extrapolation of work that is underway today. The major business firms, universities, computer companies, and many government agencies around the world both recognize the imminent arrival of the revolution and are hard at work preparing for it.

As the industrial revolution brought national strength through increased productivity of blue collar workers, the computer revolution will bring national strength through increased intellectual productivity of white collar workers. An executive with a personal computer linked to a network of colleagues and information substantially outperforms the executive of the past. Here again, many bits and pieces of the future already exist, for example using engineers with computers to design more effective computers. Certainly the existing evidence strongly suggests that the vision of the future outlined above certainly is reasonable and probably is inevitable. These arguments further suggest that those nations that move most effectively and promptly in this area will create substantial advantages both for themselves and for society as a whole. One should, of course, be equally concerned with mitigating a host of possible problems that may accompany this revolution just as they accompanied the industrial revolution.

If you accept what I believe is strong evidence for this world view, then a key question is how does the United States gain and hold a leadership position. History suggests that universities will play a key role. Professionals in our society are educated at universities. If universities can provide good networked, distributed personal computing environments for their students, then similar environments will develop rapidly and effectively among professionals in the workforce. We already have observed the major impact that professionals educated at computer intensive universities have had on the use of computers in business and government in the past three decades.

In addition to computer competent graduates, society can benefit from computer intensive educational environments in a second way. With the continuing rapid growth of relevant knowledge, universities simply have run out of time in four years to turn out graduates who are both expert professionals and educated persons. Increased learning effectiveness or productivity for students has become essential. Computer enhancement of student learning must be a major goal of higher education. Computer enhancement of faculty research is an equally important goal for the nation.

For universities to move into the next generation of networked distributed computing requires at least the following.

1. Development of appropriate technology for personal computers, system software and communications.
2. Development of meaningful educational and research applications.
3. Commitment and adequate funds to implement the systems.

Work on technology is proceeding well. For example, Carnegie-Mellon University and IBM announced last fall a multimillion dollar joint partnership to develop a next generation network-distributed personal computing system. Apple Computer recently announced the Lisa system, a product that incorporates many essential features for professional use of personal computing. Almost every computer company in the world will have a similar effort. Work on meaningful educational or research applications is proceeding more slowly. However, the needs are recognized and universities with some difficulty show promising signs of handling the problems. A number of major foundations show some interest of helping with the task. For example, the Carnegie

Corporation just committed over a million dollars to CMU and a group of other leading universities. National Science Foundation or similar support for this task certainly is welcome and productive.

The most critical unresolved issue is how universities faced by stable enrollments and increasing costs will find the capital to invest in network distributed computing systems. The capital investment per student for a reasonable 1985-1990 system ranges from a minimum of $1000 at a liberal arts college up to as much as $6000 at a high-technology school. At Carnegie-Mellon, with only 4000 undergraduates and 1500 graduate students, we expect to spend in excess of $20 million for equipment over the next five years. For any school, these investments are enormous. Parents and students already are strained with the tuition cost to keep universities operating. Financial aid resources are stretched to the limit. Universities, regardless of their level of commitment, are unlikely to be able to generate all the capital required. Even worse, they may not try.

A thoughtful program of federal matching grants for computing equipment can provide both the incentive for universities to commit additonal capital of their own and the hope that the job is tractable. A commitment of $200 million toward this goal should have a substantial impact. The program should stress the need for colleges and universities to develop careful, effective and sensible plans as a condition of funding. If done well, the program should contribute greatly to our national welfare.

Mr. Fuqua. Thank you very much, Dr. Van Horn.

Dr. Florio.

Mr. Florio. Thank you very much, Mr. Chairman. I appreciate the opportunity to appear here before the committee on behalf of the American Educational Research Association to present our views on H.R. 1310.

I would like to say, first, that we do share in the higher education coalition statement presented earlier, and we are a part of that agreement of what needs to be done in this legislative package.

We also want to praise the actions of the bipartisan cosponsors of H.R. 1310, who have included a provision for strengthening educational research and development. Section 625 in title I of the bill, we believe is a strong initial step in revitalizing the National Institute of Education's program in this area.

We appear here today to ask the committee to authorize a matching or companion program in the National Science Foundation. In the past, these two agencies have had a history of working together, and we believe that they could work together to plan, to help select outstanding proposal readers, to assure that high-quality work is funded, and because of the strength of the two agencies, we believe it marries substance and process, so that not only do we get higher-quality work on improving instruction, but also in the specific substantive areas of mathematics, science, and technology, and then, of course, to make sure it is used in schools and colleges.

We also have a recommendation with regard to some targeting of priorities with regard to title II. Specifically, the engineering and science personnel fund.

First, we believe that funding for projects designed to improve computer literacy and the development and use of computers as instructional resources in schools, colleges, and universities, are important priorities for that fund.

Similarly, we also believe that the personnel fund, and the improvement program, ought to provide support for efforts to develop instructional programs—including teacher training programs—curricula, and materials. Such development should be accomplished through the application of instructional, thinking, and learning research results to the substantive areas of mathematics, science, and technological education. We believe that these additions would improve the focus of the legislation.

Our suggestions are based not only on the kind of testimony you have been hearing, but also by reports by the National Science Foundation, the National Science Board's Commission on Pre-College Education in Math, Science, and Technology, and previous reports by the National Academy of Sciences and the Office of Technology Assessment.

In sum, the intellectual demands of the workplace in advanced education require a much broader student participation and success in mathematics, sciences and higher order academic skills, such as reading comprehension, problemsolving, written composition, creative and analytical thinking, and technological literacy.

Yet, as Michael Kurst, one of our members and a former president of the California Board of Education says, "We find ourselves in a vicious cycle of teacher shortages, outmoded curricula, and unmotivated students."

We focus our attention along on four problem areas: First, out-of-date, or out-of-field teachers—teachers who are not certified or qualified in their subject areas. This is, of course, caused by the second problem, which is a lack of, or a shortage of qualified math and science teachers.

The third area is the need for more effective and motivating teaching resource materials and teaching training resources, so that we can reach a larger number of students. And fourth, the need for greater access and more effective use of instruction technologies such as those used in schools like microcomputers.

All of the studies that have been done in this area call for a sustained program of educational research focused on four or five areas: One, research on teaching, thinking and learning, related to instruction in these critical areas; two, the application of research findings to the development of instructional resource materials and teacher training; three, research on the effects of secondary school organizations on math, science and technology; and four, research on student achievement in higher order academic skills. These skills are what a lot of businesses call the learning-to-learn skills. They want employees to have these abilities, rather than sometimes the specific training for their businesses.

Finally, we need to have some studies of local, State, and Federal policies that either enhance or inhibit the recruitment, retention, and upgrading of mathematics and science faculties.

We believe that this legislation, as it exists now, makes a strong start with a matching program in the National Science Foundation, having the two agencies work together would be a strong additional effort that this committee could make.

We believe that these recommendations ought to be put in place now. There are things we already know about teaching and learning that could be used to strengthen summer institutes and teacher training programs. Initial efforts could begin for educators and educational researchers to work with publishers and software developers to increase the quality of their products.

As we go along, and more research is done, we believe that improvement can be achieved in the resources we are using both to instruct students directly, and of course, to train teachers now and in the future.

Our statement includes, at the back, two pages of a summary of the various problem areas; the solutions that people have suggested, not only in the Federal level, but at the local and State level, and some suggestions as to where educational research and development could contribute to improvement.

I would be glad to answer any questions.

Thank you, sir.

[The prepared statement of Mr. Florio follows:]

American Educational
Research Association

AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

statement presented to the

COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES
THE HONORABLE DONALD FUQUA, CHAIRMAN

THE CRITICAL NEED FOR RESEARCH AND DEVELOPMENT TO IMPROVE MATHEMATICS AND SCIENCE EDUCATION

in

H.R.1310 — THE EMERGENCY MATHEMATICS AND SCIENCE EDUCATION & THE NATIONAL ENGINEERING AND SCIENCE PERSONNEL ACT OF 1983

presented by
David H. Florio, Director, Governmental & Professional Liaison, A.E.R.A.

February 16, 1983

1230 SEVENTEENTH STREET, N.W., WASHINGTON, D.C. 20036 (202) 223-9485

AERA Statement to the Committee on Science & Technology

Regarding - H.R.1310 & Support for the Section to Strengthen Educational Research

Mr. Chairman, I am David Florio, Director of Governmental and Professional Liaison, the American Educational Research Association. I want to thank you for the opportunity to appear today on behalf of the American Educational Research Association. I am presenting our views on H.R.1310 and the critical need for research authorities associated with new legislation in mathematics, science, and technology education. We want the Committee to know that we join in the statement presented on behalf of the higher education community.

WE ALSO WANT TO PRAISE THE ACTIONS OF THE BIPARTISAN COSPONSORS OF H.R.1310 FOR INCLUDING A PROVISION FOR SUPPORT OF EDUCATIONAL RESEARCH AND DEVELOPMENT. Section 625 of the bill provides a strong initial step to revitalize the National Institute of Education's research program focused on the critical issues facing math and science education.

We appear before the Science and Technology Committee to request that you match the program in the National Institute of Education with a strong program of instructional research and development in the National Science Foundation. The NIE and NSF have managed joint research programs in the past and, with these funds, a combined effort would bring the strengths of both agencies to focus on critical research, development, and instructional improvement support. NIE has a specific statutory authority to administer joint programs and should be the designated program manager; however, directors of the two agencies would work together to plan and implement the research program, select outstanding proposal readers to assure that high quality work is funded, and work to make sure that the results of funded research is both useful and used to improve educational practice.

We also recommend the following priorities for the Title II (formerly HR582) "Engineering and Science Personnel Fund":

> A. Funding for projects designed to improve computer literacy and the development and use of computers as instructional resources in schools, colleges, and universities.
>
> B. The development of instructional programs (including teacher training), curricula, and materials through the application of instructional, thinking, and learning research results to the substantive areas of mathematics, science, and technological education.

These priorities will allow the Foundation to address some of the specific concerns of educators in colleges and schools. These recommendations for H.R.1310 are designed to improve the focus of the legislation. As noted below, the problems are complex and diverse and the solutions must be focused and effective. We need to improve the capacities of educational institutions to deliver effective education to school and college students.

RATIONALE

There is little need to reiterate the studies and research which have defined and clarified the various issues and problems associated with learning in math and science. The National Institute of Education, the National Science Foundation and the National Science Board's Commission on Precollege Education in Mathematics, Science, and Technology, the National Academy of Sciences, the Office of Technology Assessment, and various witnesses have identified the central issue and priority education problems associated with math, science, and technical literacy. Briefly stated:

> The intellectual demands of the workplace and advanced education require much broader student participation and success in mathematics, the sciences, and the higher order academic skills -- reading comprehension, problem solving, written composition, creative and analytical thinking, and technological literacy.

Yet, as Michael Kirst recently summarized:

> "...we find ourselves in a vicious cycle of teacher shortages, outmoded curricula, and unmotivated students." ("Improving Math, Science and Technical Education" California Commission on Industrial Innovation, July 1982)

The research and testimony focus on the following priority problems:

1. Out-of-field and out-of-date teaching force. Many teachers are in math and science classrooms, particularly in secondary schools, who are not prepared to teach the courses they are assigned. They serve with "emergency certificates" or have little recent information on math, science, technology, and instructional advances.
2. Severe shortages of qualified math and science teachers due to an inability to attract new teachers to the classrooms or to the inability to keep able and effective teachers.

3. The need for more effective and motivating teaching resource materials and teacher training resources so that we can reach a larger number of students. Due to dramatic cuts in educational research and development, dissemination and technical assistance, the capacity to improve student motivation and learning and to adequately prepare and update teachers in mathematics and science has declined.

4. The need for greater access and more effective use of instructional technologies. The micro-computer and other information technologies are unevenly distributed in education institutions, they are under-used for instructional purposes, and the software materials are not adequately developed with an understanding of the latest research on student learning and instruction.

With few exceptions, research and the reports on the problems and issues call for a sustained program of educational research as an essential resource for other federal, state, local and institutional programs to improve mathematics, science and technical education. The following educational research efforts should be seen as priorities in new math and science education legislation--

(a) research on thinking, teaching, and learning related to instruction in math, science and technology, including reasons for learning difficulties and the instructional uses of information technologies;

(b) the application of research findings to the development of instructional resource materials and teacher training programs;

(c) research on the effects of secondary school organization and instructional strategies on student learning in math, science and technology;

(d) research on student achievement in higher order academic skills -- reading comprehension, written composition, problem solving and creative, analytical thinking, including computer and technological literacy-- which are essential for work and further learning;

(e) analysis of local and institutional policies enhancing or inhibiting the recruitment, retention, and upgrading of mathematics and science faculties.

For each of the priority problem areas outlined above, new research projects and efforts to use current findings of educational research will provide knowledge and informational resources that are needed for educational improvement. As will be outlined below, these studies will contribute to both short-term efforts to ease immediate problems and long-term fundamental solutions.

The Uses of Research Findings

Educational research has made important progress in identifying successful teaching practices, effective school characteristics, and student learning. Although the majority of these studies have been focused on elementary schools, progress has been made recently which will contribute instruction at the secondary and postsecondary education levels, particularly in mathematics and science. There is significant need for further work in these areas; however, not all of what is known is effectively incorporated into instructional materials and teaching practices. For example, recent research on how learners approach math and science problems is ripe for development into improved diagnosis and instruction.

The Promise of Emerging Research Finding & New Research Programs

Fortunately, past and current research efforts are, although poorly funded, on the right track. They allow us to build new research on past knowledge, to ask the right questions and, most importantly, to provide practical and useful information to those in the front lines of education --the teachers, administrators, and education policy makers.

The focus of research studies on mathematics and science instruction will help us blend the need to learn substantive knowledge with effective instructional strategies. In past efforts, either too much emphasis was placed on providing teachers with new mathematics and science information --to the neglect of realistic ways to assist students in real classroom situations-- or too much focus was placed on teaching process concerns --to the neglect of important substantive curricular needs. Recent improvements in research will allow the research authorized in H.R.1310 to promote an appropriate mix of process and substance and their application to:

--instructional materials

--teacher training programs

--school-site instructional improvement

--secondary school math and science programs

--advances in technological literacy and the appropriate and effective instructional uses of information technologies.

These research and instructional improvement efforts need to be initiated NOW. The outmoded instruction and curricular materials and strategies demand upgrading. Our methods of teaching mathematics and science, successful for a small number of students pursuing academic careers in these areas, are not adequate for the much broader student population needing these academic skills. The demands of work and essential academic skills, what employers call these "learning to learn" skills, require that we provide teachers with the best available knowledge and material resources.

In summary, I would like to outline the priority problem areas and indicate potential solution categories and the contributions of current or potential research findings.

Summary of Math and Science Education Problem Areas

(Possible solution categories and research and development contributions)

Note: These possible solutions have been identified from proposed legislation, state and local efforts, and from testimony. They are not specific recommendations by AERA.

OUT-OF-DATE AND/OR OUT-OF-FIELD (UNQUALIFIED) MATH AND SCIENCE TEACHERS

Most immediate solution categories:

--individual continuing education for teachers already in service (substantive knowledge in subject areas and recent developments in teaching strategies);
--staff development at the school site (working to make the school and classroom effective places to teach and learn).

R&D Contributions

Immediate contributions of effective teaching and school research findings to teacher training programs are needed to mount inservice education programs and staff development efforts. Particular fields for research application include: math and science classroom management and instructional strategies, student thinking and learning, and initial identification of effective secondary school characteristics.

OUT-OF-DATE OR INEFFECTIVE TEACHING RESOURCES (materials/strategies) & TEACHER TRAINING PROGRAMS (for new teachers and those already teaching)

Solution categories:

--the improvement of teacher training and staff development programs (using available information on mathematics, science, and instruction/learning strategies);
--the development of curricular materials, including computer software;
--developing reward systems which bring together teachers and teaching resource organizations.

R&D Contributions

--the application of teaching and learning research to the development of texts, instructional software, and teacher-developed instructional programs.
--new R&D into student motivation, thinking and learning, and applied research on classroom teaching in mathematics, the sciences, and technical literacy.
--reasons for learning difficulties in M&S.
--the identification of essential academic skills needed for successful work and future learning (including on-the-job training).

THE LACK OF QUALIFIED TEACHERS ENTERING THE PROFESSION, AND THE LOSS OF CURRENT TEACHERS TO OTHER OCCUPATIONS.

Solution categories:
--teacher education incentives and support;
--status improvement of the existing teaching force;
--using qualified teachers in staff development efforts;
--providing financial rewards for entering and staying in math and science teaching.

R&D contributions
--analysis of local and institutional policies as they affect the recruitment, retention and professional advancement of teachers.
--comparative studies and dissemination of effective strategies for coping with the problems.
--collaborative research using qualified researchers as teacher-researcher partners with principal investigators on math and science education research projects.

LACK OF ACCESS AND EFFECTIVE INSTRUCTIONAL USE OF COMPUTERS AND OTHER INFORMATION TECHNOLOGIES

Solution categories:
--provide funds for the acquisition of micro-computers and other technologies
--provide incentives for corporations to provide schools with low cost or no cost equipment;
--provide support and incentives for educators and publishers/software developers to work together on the development of improved resource materials;
--provide support and incentives for schools to work with private and public sector math and science resources --museums, libraries, scientific laboratories, the media, and so on.

R&D Contributions
--the application of teaching and learning research to the development of texts and software.
--R&D into the effective uses of computers and instructional technologies in realistic classroom settings (for computer literacy and for instruction in mathematics and science).

--research to develop criteria for school boards, teachers, and administrators to assess the value of various types of instructional hardware and software.
--research on the effects of new technologies (both in and outside of schools) on student achievement in academic subjects.

I thank you for this opportunity to present the views of the research community. I will be pleased to answer any questions. The American Educational Research Association is most willing to work with the Committee to provide information resources which yo equest.

Mr. **Fuqua**. Thank you very much, Dr. Florio.

I might say to the members, that because of the time and some of the problems that some of our witnesses have, we are going to limit the time to 3 minutes per member, instead of 5 minutes, as we were before.

While my time is ticking, let me, Dr. Gillespie, you mentioned sharing equipment with the Boeing Co. because of the uniqueness in the State of Washington; Dr. Van Horn, you mentioned purchasing computer equipment for students.

Who should own this? Do you get any problems if this owned by private industry, or should the university own it, or should the student? Maybe both of you could share, and maybe Dr. Florio has an opinion on that also.

Mr. **Gillespie**. Let me comment. There are some differences between public and private——

Mr. **Fuqua**. Correct.

Mr. **Gillespie** [continuing]. Universities that affect what you can do. For instance——

Mr. **Fuqua**. Size of the equipment, too.

Mr. **Gillespie**. And the size of the equipment. For instance, recently, with the interest in personal computers, many of the manufacturers are offering to pass on the kind of discounts that they might offer to a university which is purchasing in a large amount, so that faculty and students could buy them.

Unfortunately, many public institutions, because of State laws—normally you have a purchasing process, and you cannot use the purchasing process for private use—there are some difficulties in passing on the discounts.

I see this as a State problem, of which there are some alternatives. For instance we have been considering using our bookstores as the agent. The role of the bookstore itself may change over the next few years because in addition to books, bookstores today already sell personal computers, software, and it may reflect an appropriate change.

While sharing equipment brings up some problems, in many other cases, we can solve issues such as title.

Mr. **Van Horn**. I think it is clear that, as I said before, that in the next 10 or 20 years, that the main form of computing that you will see are small machines which are used by a single individual. This direction seems to be clear and it provides computing support that is very different from any kind of computing we have ever had before.

Our own plan at Carnegie-Mellon is that students who arrive starting at about 1985 will receive their own individual computer. It will be paid for out of their tuition. They will take it with them when they leave. I don't think one for one is an essential part of the program. You could share personal computers, but our feeling is that we will get better results with a machine for each individual, and that the machines will, in effect, be owned by the individuals.

Sitting behind those machines is a fairly elaborate network of communications, and of special-purpose facilities. These are not individual machines that stand alone. They communicate with large data bases, they communicate with special facilities such as high-quality printers, color printers, and color plotters, and a variety of other kinds of special-purpose or special-use facilities.

So there are two pieces. There are the individual machines owned by the students, and there is an extensive central network which adds a lot of power and usefulness to these machines.

Mr. **Florio.** I was just going to add that in the interest of the equipment, we mustn't forget the software behind it. In our analysis of people doing research in this area, both at the school and the college level, particularly when we are talking about educating a broad number of people, and not just the people going into computer science, and the use of them for higher levels of engineering and science, are that the quality of the software isn't very good right now, and we need to have some cooperative relationships between universities and people who are going to be developing software and publishing and so on, so that we make that a better tool, because the machine itself isn't particularly useful if, in fact, as one of our people who has been using computers to teach—to figure out ways we can teach reading better, for example—indicated that they just took the text—the workbooks weren't very good to begin with, and wired them for sound.

What we need to do is be creative with the use of the computers, so it can be an effective instructional tool, and I think that is a thing to remember while we talk about the use of the equipment, we need to know the backup behind it.

Mr. **Fuqua.** I can't help—with children of mine still in college—making the one remark that I hope you don't with the computers what you do with books, where you change them every semester or every year, and they are obsolete. I couldn't help but get that in.

Mr. Gregg.

Mr. **Gregg.** Mr. Chairman, I will pass the 3 minutes. Thank you.

Mr. **Fuqua.** Thank you, sir.

Mr. Walgren.

Mr. **Walgren.** Thank you, Mr. Chairman. I just wanted to focus on one fact that Dr. Van Horn raised. How much was it, again, that Carnegie-Mellon is anticipating spending on instrumentation in a 5-year period?

Mr. **Van Horn.** Well, just on trying to bring ourselves into what we believe is a modern computing environment, we expect to spend $20 million. We have, over the past 5 years, spent $10 million. We probably have the best educational computing environment today in the Nation. We don't think it is the kind of environment that we need in the future, but it served us well in the past.

So we plan an additional $20 million expenditure. We believe that computing is an extremely valuable tool for education. We worry about how to educate students in 4 years; we can't do it any more. If we can enhance student learning effectiveness with computing, we see that as very valuable for the educational process.

I would assume that other schools will choose to spend less, but I think the range is someplace between $1,000 to $6,000 per student. I think all universities will have to make expenditures in that range, and that is an enormous expenditure for the country, and for the university system.

Mr. **Walgren.** And that is over and above the individual computer that the student is procuring through his tuition.

Mr. **Van Horn**. No, that is included.

Mr. **Walgren**. It does include that component.

Mr. **Van Horn**. That is included in my number, yes. That is part of the total investment.

Mr. **Walgren**. Thank you, Mr. Chairman. But I just think the point is that the instrumentation side of this is a very expensive item that may not cover an awful lot of ground when we talk about numbers of students.

Mr. **Fuqua**. Mr. Winn.

Mr. **Winn**. Just a brief question.

Other than computers, there obviously have to be other types of equipment technologies to make these—to improve the educational processes. Have any of you done any work in other types of equipment, other than the computers?

I mean, do you have any estimates of what you might spend per student?

Mr. **Gillespie**. Well, let me give you a number that is an interesting one, because we often don't hear it. And that is approximately how much we spend per student on the library. I pick that because, to some extent, the library has been our information resource and we all have a feeling for what it means to have a reasonable library, the hours of access, books, etc.

In this country, the amount that we spend per student is somewhere around $100 to $200 per student per year. So that gives us at least a measure of cost of access to that facility. Today, in this country, we are spending something on the order of $20 to $40, per student per year on computing activities, primarily for the undergraduate.

When we talk about increasing access sizably, we mean in changing from computing to information resources at the scale of the library.

A part of those resources, for instance, we have had a number of experiments with new technologies like video discs, using them in different ways in the instructional process.

I find it hard to separate computers from most of the technologies, because the microprocessors are one of the reasons we can do part of what we do. But when you use those tools, you are not really doing computing, you are just using them as a tool.

Mr. **Van Horn**. I would like to reinforce Mr. Gillespie's remark that computers really become the center of our information net. For example, we tried to use television to improve education, and it was not terribly successful, because there wasn't adequate interactive component.

We can use television through video discs, because with computer control of video, you can interact. You can provide instructions to a microprocessor, see displays on a video disc, and make decisions or reactions to that video image again with a microprocessor.

Having this interactive capability does enhance the video technology we already had that wasn't very effective, The computer is our central intellectual technology, not only in universities, but in the rest of our society.

For example, libraries will be largely computer based within another 20 or 30 years. We won't buy books in the standard form very often. We will have most of our materials, our information storage for society and for civilization, in the form of computer-stored information.

We can't afford traditional libraries any more.

Mr. Florio. I just want to add briefly on that, that your recent study, to which some of our members contributed, from the Office of Technology Assessment, said not to just concentrate on the microcomputer. It is a very essential element in this whole discussion, but there are two-way communication, videotape and disc and a variety of other kinds of educational tools that can be used in conjunction with the microcomputer and with the classroom instruction process itself.

I would emphasize again, those are tools, and behind those tools, we have to have effective software and instructional programs that go into them. I am here today to request that the committee concentrate on the quality of the instructional program that goes behind the instruments, because they are not very good by themselves.

Mr. Winn. Thank you.

Thank you, Mr. Chairman.

Mr. Fuqua. Thank you, Mr. Winn.

Mr. McCurdy.

Mr. McCurdy. Mr. Chairman, I just have one quick question.

I think each of you have seen the rough drafts of the bill, and we have had a number of people testify as to the priorities, and again, you are talking about instrumentation, but in looking at the other portions of the bill, are there any other priorities or are there—if you were able to have a change or make a change in the direction, as far as the institution it goes to, higher education, secondary, elementary, or what—if you had a general statement that you would like to leave as far as the bill itself; where you think it adequately addresses it, it doesn't go far enough; you think there should be some changes in certain areas; being realistic, if you can.

Mr. Van Horn. I think we always face the problem in a democratic society between trying to provide broad assistance and trying to focus in on a relatively small number of issues which probably make a great impact.

I am certainly not wise enough or reckless enough to try to comment on how the political process works or how it should work. But I think the way that you do make an impact on the country and on society is to find some areas of great importance and to act on those.

Research equipment in science and engineering is important, and part of the bill provides for research equipment in science and engineering. I believe computing equipment is a very important subset. Helping to make universities and colleges increasingly attractive to engineering and science faculty members is an area where Congress can have a substantial impact.

I personally would tend to provide high priorities on those things where you have a high guaranteed impact.

Mr. Florio. Let me say that our statement isn't just on the technology, it is on the broad areas of improving instruction at school level, elementary and in the high schools, and at the universities and colleges.

We have discovered in the educational research field that what happens in the elementary school can have a broad effect on our ability to deal with children and youth in junior high and high school.

We need to concentrate on what some people call the higher-order basic or academic skills. These have been neglected in order to reach the back to basics that a lot of people concentrated on.

We find that the test scores are up in simple mathematics computation, but they are down in problemsolving. They are up in reading and word recognition kinds of skills, but they are not so hot in comprehension. Creative, analytical thinking skills can be taught.

People at Dr. Van Horn's university, particularly the Nobel Prize winner Herb Simon, who works with our people in the Learning Research and Development Center at the University of Pittsburgh, have been doing some very creative work in the area of cognitive science. They combine three different disciplines in their work: Cognitive psychology, teaching and learning research, and computer science, to look at the way children approach problemsolving.

They are finding out that children aren't just blank slates, they have all sorts of creative ways of thinking about these things, but they are often wrong. And they have to be retaught. If we don't catch those errors early, they make them and they bring them all the way to their beginning college courses.

We have some evidence from some of the tests on beginning physics and algebra at the freshman level showing students are making those basic mistakes.

We need to concentrate on the quality of the instructional programs and teacher training. We mustn't just focus on one level, but look at the broad scale from the elementary schools through the university.

Mr. FUQUA. I think Mr. Gillespie wanted to respond.

Mr. GILLESPIE. Just to answer briefly, I think that the whole educational process is a very complex pipeline. And since it has a certain width, we can produce things through it at a rate. In higher education today, we have a feeling for how much, with the resources we have and how they are deployed; what we can do.

I think it is critical to pay attention to those areas. In the same way, it is critical to pay attention to how students are affected who are entering that pipeline. So I think that the bill addresses—particularly in the elementary and secondary school areas—where we would like to be as a nation. It will not be effective if we manage to educate the last generation of children who are capable of taking on problems. The balance is critical.

Mr. FUQUA. Thank you.

Mr. Lewis.

Mr. LEWIS. Thank you, Mr Chairman.

Dr. Florio, I would like to ask you the same question, essentially that I asked Dr. Holland previous. In your paper, you bring out the problems without a field, an out-of-date teaching force, and the severe shortages due to your research. Do you have any proposals of using this bill as a foundation how to eliminate the faculty flight and the piracy, after getting good science, math, and computer science instructors from jumping into the private sector?

Mr. FLORIO. I don't have any particular studies on this. I think what we have learned in part is that although the salary problem is a reiterative one, everyone talks about it, I think there are alternatives to simply differentials in the school salary that will allow people to be attracted to or to stay in teaching.

It isn't just attracting people into the teaching profession, but keeping the good ones we have there.

Some of the summer opportunities, both in terms of updating some of their skills and in participating in some of the research work. For example, the Institute for Research on Teaching at Michigan State University—a national institute of education-funded institute—uses teachers in the field to work in their research projects.

They are, in part, compensated, but I think the more attractive part of the work is being actually able to participate in a broader area than their immediate classroom instruction.

I think that we have to look at a variety of kinds of opportunities. One thing this legislation ought to encourage is collaboration between schools and universities, and with private-sector forces where they are available. We need to avoid a situation where we say "This is mine and this is theirs." Our energy should be aimed to create ways that that money can be used cooperatively at the local level and at the institutional level in the case of higher education institutions.

One thing we have learned from educational research is that teaching is very context specific. It depends on the situation where you exist. It is a lot easier to cooperate with a high-tech industry if you happen to be in certain parts of Massachusetts, Texas, California, or Colorado. It is a little less easy when you are in a place that doesn't have one handy.

You have to figure out different creative ways to provide teachers with those experiences. The computers can help with these cross-country educational experiences. I don't think at the Federal level you can design a program which will reach every individual situation.

But you can provide funds and incentives for people to be creative on their own.

Mr. LEWIS. Thank you, Mr. Chairman.

Mr. FUQUA. Thank you, Mr. Lewis.

Mr. Reid?

Mr. REID. I have no questions, Mr. Chairman.

Mr. FUQUA. Thank you, sir.

Mr. Bateman.

Oh, pardon me. Mr. Lujan.

Mr. LUJAN. Thank you very much, Mr. Chairman.

When we first—when this whole thing started coming up, we thought we would try scholarships, that sort of thing. The chairman introduced a bill at that time. So we all looked for ways to train young people in what we think are the jobs of the future. And I think this is what it is all about.

The thing has gotten rather complicated. I started out thinking what we really ought to do is make some moneys available to those

States and local jurisdictions so that they can buy equipment for their laboratories, the computers, all the kind of equipment that we are talking about, if they will set certain curricula; to States if they would set up certain criteria for certifying teachers.

I am not really sure that it is the responsibility of the Federal Government to train teachers for the task that we want them to. I think that perhaps maybe it would be better if we encourage the States to give preference to those teachers that have those qualifications, without going into the scholarship thing, the training for administrators and all of those things.

Just use the carrot approach. If you set up your curriculum in such a way in your certification, we will give you money for all of those things that you need. It would probably be a lot less expensive and maybe, at least in my opinion, a lot more effective.

What do you all think about that?

Mr. Florio. Sure we should increase some of the standards that you are talking about, but I don't think we can do it alone.

A lot of States are encouraging their institutions of higher education to raise their admissions standards, because they feel the high schools will, in turn, raise their course offerings or focus on the more academic areas.

That is not a bad idea as an initial step, but we have certain States, and the State of California is a prime example, where you can demand more courses, but unless you have the teaching force there to deliver the services, you create a tremendous problem at the secondary levels.

Take their brightest elementary teachers in on an emergency certificate, put them in the secondary levels, teach them math courses there, meanwhile, they don't have anybody teaching mathematics who knows much about it at the elementary level.

The Federal Government can provide some leadership, some seed money—this is a fairly modest bill, compared to what is being spent on education around the country, and what is being spent, probably in this area, but sporadically. If we make sure the way the Federal Government's money is used is of high quality, high impact, then I think that we can have an effect which is much broader than the individual project funded by the Federal Government.

We can back up what State legislatures and local schoolboards and institutions of higher education are trying to do on their own.

Mr. Lujan. Well, you don't think they are just upgrading the curriculum, and upgrading the requirements for a teacher before that teacher can be certified. It would seem to me like if I have to have certain courses in education and math and be proficient in it, otherwise I wouldn't get hired, I would go get them.

But if the Government wants to give me a scholarship to get it, well, that is fine. But I think that, first of all, I would go get them on my own.

Mr. Fuqua. Thank you, Mr. Lujan.

Mr. Skeen.

Mr. Walker.

Mr. Walker. Thank you, Mr. Chairman.

As I understand the issue that we are faced with, the bottom line on it is that we have too few people in the field to do the job that needs to be done if we look toward the future. What I am trying to do in my own mind is plug in just exactly the kinds of things that are needed.

So, from your perspective, how many additional people are we going to get in the field, as a result of putting state-of-the-art equipment in the laboratories? Is that going to be a significant contribution to getting more people to fill these 20,000 slots that we have that we need trained people to fill?

Mr. **Van Horn**. I only can talk about the higher education component. I tried to make the point that there really are two issues: The number of people you turn out, and the amount of work that you can expect from each of those people. I think putting high-quality computing systems into universities does change substantially what you would expect out of engineers and scientists who are going out into the industrial establishment.

I don't think it has a dramatic effect on getting engineering and science faculty members in universities, but I think that situation shows every sign of getting better at the present time.

I think we do see a lot of evidence that we are able to hire faculty, and we are able to hire good faculty and to retain good faculty. If we are able to better meet the needs of industry, if engineers become more productive, or if scientists become more productive, then the tendency of industry to draw engineers and scientists away from universities certainly will diminish.

I think the other argument is that a society is better off if universities turn out people who are trained at the frontiers of their field.

Mr. **Walker**. Well, part of my concern is the fact that we are dealing with a limited resource situation here, obviously. And that is put alongside of the fact that, at least in the public schools, it is indicated we need maybe 16,000 people at the minimum to fill the slots where we can now utilize such people.

Now, I certainly agree with you. If we add state-of-the-art laboratories, we are going to turn out a higher quality person, but is that really the issue? I come from an educational background. My father was a college professor. I was a teacher before I got into this whole business, and it still comes down to the fact that in education, the fundamental relationship is between teacher and child, or teacher and student, professor and student.

That is the fundamental relationship. All the rest of it, from administration to equipment and everything else is add-on to that fundamental relationship. And when we are dealing here with what we have got to do with limited resources, doesn't it make sense that we would use those limited resources then, in a way to foster that relationship between teacher and student, and we would make certain, then, that fundamentally we had enough teachers to meet the needs of the students out there?

Mr. **Florio**. I agree with the statement that we must focus whatever we do, either with the equipment or with the instructional programs in math and science generally, on our basic resource, which are the teachers.

I think what we are discussing today, and again, I am not speaking here just of computers, I am speaking of improving the quality of all instructional materials, and the resources for children, which are the teacher training programs, the substantive knowledge that teachers get before they go into math and science, and then the ability to deliver it in classrooms in effective ways.

We have found out that much of our materials are not very motivating to students. And we need to provide teachers with the tools which will encourage students.

Also, it doesn't do much good to either have a single good math teacher or a single good computer classroom in an ineffective school. So we need to focus on those things as well.

Mr. **Walker**. Obviously, you can't teach computer learning without some computers available.

Mr. **Florio**. That is correct.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Van Horn**. I think you are certainly right, that there is an important relationship between student and teacher. I don't think anybody wants to change that relationship. There is another equally important aspect of higher education, that students really don't have much contact with faculty members.

Most of what happens to students happens either on student-to-student interaction or happens with a student working by himself or herself.

One of the things that we are trying to do is to make the time the students spend by themselves, which is the largest part of their education, far more productive. And I think that is a critical issue.

Mr. **Florio**. You can have had the inverse situation in schools where we have most of the learning going on with student-teacher contact, particularly at the elementary schools, and of course, in high schools, as well. The time the students engage in the learning tasks, of course, directly relates to how much they learn and how well they do it.

Students aren't spending enough of that time doing that. They are disrupted; teachers are teaching small groups and neglecting other parts of the class. Perhaps some of the technology can help us reach more students effectively and use their time better.

Mr. **Fuqua**. Mr. McCandless.

Mr. **McCandless**. Mr. Chairman, I think our three witnesses have given a comprehensive testimony on the subject, and I have no questions.

Mr. **Fuqua**. Thank you very much. And let me thank all of you for being here today. We appreciate your contribution, and apologize for the lateness in which you were able to get on the program. We appreciate your testimony, and you have been very helpful.

Our next witnesses, from the private sector, is Mr. Don Dimancescu, Technology and Strategy Group in Cambridge, Mass., and Mr. Robert Finnell, executive director of mathematics, engineering, science achievement at the University of California at Berkeley.

Mr. Dimancescu, I hope I am pronouncing your name correctly, or close enough. Thank you, sir. And you may proceed.

STATEMENTS OF DON DIMANCESCU, TECHNOLOGY AND STRATEGY GROUP, CAMBRIDGE, MASS.; AND ROBERT FINNELL, EXECUTIVE DIRECTOR, MATHEMATICS, ENGINEERING, SCIENCE ACHIEVEMENT, UNIVERSITY OF CALIFORNIA, BERKELEY

Mr. **Dimancescu**. Thank you very much for allowing me to be here. As with other individuals, I would like to enter a background document into the record.

Mr. **Fuqua**. Yes; we will make that part of the record, and if you wish to summarize, same with Mr. Finnell.

Mr. **Dimancescu**. It allows me to be much more brief in my comments.

A quick background: I am a consultant to high-technology companies, and I speak today as an individual, not representing any particular interest group, and I am here also to represent some views that I have expressed in a book that was recently published called "Global Stakes: The Future of High Technology in America," a book coauthored by Dr. James Botkin, a consultant in education, Mr. Ray Stata, president of Analog Devices, a high-tech company in the Boston area, and myself.

In that book, we invited a number of individuals to express some views in a final chapter of the book from many different sectors of our economy and culture.

Three example: Gov. James Hunt from North Carolina wrote a very interesting strong piece on education, economic growth, and the need for national policy; Dr. Paul Gray, president of MIT, wrote a piece; Mr. John Young, president of Hewlett-Packard, wrote a piece; and several other individuals.

These individuals were expressing views from very different sectors of the economy.

The issue that you have before you today, and that I have addressed, is an issue that really has no party label. It has no special interest label, it could interest labor as much as industry, academia and government, and it is an issue which, in our view, is one that should encompass bipartisan interest, and House-Senate collaboration, and a lot of collaboration between the Congress and the White House.

That movement is beginning to happen, I think. I want to compliment the members of this committee for moving as fast as you have in developing an initiative on this issue. But at the same time, I would like to encourage a lot more effort on the part of this committee to look for those other components of a successful effort which I would call a bipartisan interest, or that I would call a partnership between Congress and the White House.

To date, those pieces are missing. My belief is that there is a lot of momentum building in the Nation occurring during the last few months behind this issue, and we are just at the beginning of seeing solutions to the issue.

So, in that sense, I am looking at a piece of legislation, H.R. 1310, which, to me, is a beginning. But we are a long, long way from resolving what is a very huge problem. The size of the problem, I think, is well understood in your legislation, in which you have phrases that alluded to the need for a comprehensive policy and a need for a national policy on this issue.

Unfortunately, you have had to be far too realistic in the timidity of your efforts. I believe that they are timid in the sense of not touching all of the bases you might have been able to touch, and clearly in the amounts of moneys that you are talking about in this measure.

Let me come back to that in a minute. I speak here not as a Democrat or Republican, but I do find it heartwarming to realize that in the state of the Union, the President discovered the word "technology"—even "high technology"—and he also discovered the word "education." I think that is a very significant event, at least in what is beginning to happen in the White House.

But, at the same time, I noticed a few days back—2 weeks back—the New York Times published a text of the President's economic statement or economic report, and I read it very carefully. To me, the issue that we face today brings two words together, and those words are "education and economic growth." Yet, when I read the President's economic report sent to Congress, I searched desperately for the word "education," and you cannot find the word "education" in this economic report to the Nation.

As we sit here today, I think what we are doing and attempting to do is to link those two words together, that we will not have an economic program in America or a competitive program vis-a-vis the Japanese, or a military program vis-a-vis the Russians, if we don't link these two words, "education and economic growth."

In that sense, I think the President is still one step away from where he should be, but I am guessing that the momentum is happening maybe in this session to bring him closer to realization.

I don't want to go over old ground which I think will put you to sleep, but I do want to mention six points, almost in buzz words, which I call the new challenges which allow us to interpret the validity of your initiative and maybe others. I will go through them very quickly with just a few examples to give them more meaning.

I don't think any of us would question the fact that America, in the last decade or two, has gone through what I would call structural change in its economy. The America of the 1950's and 1960's is not the America of the 1980's and clearly will not be the America of the 1990's. The economy itself has changed fundamentally. One of the key components of that change is that the role of education in underwriting or promoting new and future economic growth will be higher than every before in our history. That is because most of the industries, growth industries, of the next decade will be industries that depend on education for their vitality.

The one industry where I have more familiarity, which is electronics and computers, today has sales of about $145 to $150 billion—which if you divided by $7,000, the price of an average car in Detroit, is equal to about 20 million cars in value. It is an immense industry. It is expected that by the year 2000, just that one discrete sector, electronics and computers, will be second only to energy in size.

If you take one company—and let's take Analog Devices, the company of my coauthor, and it could be Hewlett-Packard or any other—one-third of the employees have college or higher degrees, one-third of the employees have a technical education, and one-third are basic skilled people. That immense emphasis on educated people is the key to those corporations' success today and in the future. I think we all know that it is in that area that we are faltering. We are not turning out the well-educated labor for the future.

The second key challenge is competition. I won't go into the background on that. It is almost self-evident that the Japanese are giving us a race for the money, and so are the French, so are other countries as surprising as Korea, Taiwan, Singapore—small, little Singapore, 2 million people, and yet it can challenge us. The Germans, if they can turn their economy around, and there are signs that they might be able to do it, will be very serious challengers.

America is losing the race, not because we are necessarily getting less good at what we are doing, but others are getting far better at what they are doing.

Our high-technology based defense budget is another challenge. To me, the inordinately high numbers attached to it over the next 4 or 5 years do work to our detriment if they siphon manpower away from that one sector which is really producing bread and butter for our economy and contributes so greatly to the balance of payments. The defense budget is not acknowledging the siphoning of manpower away from the private sector. It should acknowledge it, in my view, by making a larger investment in education.

It is clear that we have a decline in the funding situation affecting engineering and science nationwide. We also, which is a fifth point, have a decline in the standards of education in high schools and elementary schools.

Last, another vitally important point, I think, is that we are all aware probably of the demographic trends By the year 1990, there will be 20- to 22-percent less 18-year-olds in our culture. In Massachusetts and some of our neighboring States in New England, there will be 40 percent less 18-year-olds than today. This means attracting new people into the high-tech sector which is now our most bullish industry. Those new people will be women and minorities. Those people will be needed in order to sustain growth in our industries.

This means a concerted effort there alone to draw them into the economic mainstream. That starts not at age 18 or 16 or 25, but at age 5, the day you go to school.

In "Global Stakes," we made a recommendation which I will share with you because it will be translated into legislation on the Senate side. We made a recommendation that we should look back 120 years ago to the Morrill Act which established our land-grant institutions as a precedent for the kind of effort required today.

I say this because part of that initiative may have some prescriptive qualities that may affect your thinking, maybe not in this piece of legislation, but in the future. In our view, there is a very, very important thing happening today, which is not unlike what happened 120 years ago. One hundred and twenty years ago, our economy went through a basic structural change from being a labor-intensive nonmanufacturing industry to being a very agriculturally productive economy which could throw off labor into the manufacturing industries.

That process was stimulated and allowed to mature through the establishment of the land-grant colleges, which created a huge network of institutions. They were there to train people in agriculture and mechanic arts and many other fields. That was a revolutionary act. It also introduced the notion of Federal-State partnerships in funding that process.

Today we are going though the same kind of structural change in our economy with one new element added into it. That new element is industry. In our judgment, today you cannot have an education program if you do not marry through legislative incentives industry to academia, to State government and to the Federal Government. It is that partnership which will define the new education for the next decade or two or three. Legislation that invites that partnership to grow and mature will be the legislation that succeeds in stimulating this economy and leading us toward those goals or those resolutions to problems that you heard defined today and on other occasions.

That is why when I read your legislation, I said in my earlier statement it is timid. I don't think it goes the full length in recognizing the potential of this new partnership between industry, academia, State and Federal Governments.

I don't think it provides enough money. In the engineering departments alone, 250 to 300 of them nationwide, there is a billion dollar need for equipment, salaries, buildings—a billion dollar need there alone. You are talking about $100 million. It doesn't even show up statistically when compared to the defense budget.

And I think there is a need also to recognize that education has gone through one more fundamental change. Education is no longer from age 5 to age *x* when you get your degree, but it is a lifelong process. Education does not end in the new economy, and there has to be recognition of this ongoing function, and there has to be a redefinition of the Government role in recognition of this ongoing function. I don't think that is fully recognized in your legislation here.

I am not here to criticize you for what is an excellent effort; I am here to suggest that we are just at the beginning of a very large effort to solve a very big problem. I would urge far more effort on your part to look for that bipartisanship, that relationship with the White House, and a far more comprehensive and, unfortunately, far more expensive resolution to the problem.

Thank you.

The CHAIRMAN. Thank you very much.

Mr. Finnell.

Mr. FINNELL. I am delighted that the crisis in secondary school math and science education has captured your attention and the attention of many other organizations, committees, and States. After all, this crisis means that hundreds of thousands of individuals work in the Silicon Valley, Route 128, and other high-technology areas. Furthermore, I look forward to the growth of genetic engineering from an R&D to a startup effort so that thousands more are working in that area.

As the previous speaker has mentioned, America is undergoing structural changes. If we are proposing to solve the crisis in math and science education, particularly at the secondary level, then we are going to have to develop a different way of defining the problem, at establishing objectives, and implementing systems that will lead to the kind of country that we want to have in the future.

So I would suggest that we should now recognize that we need to produce a glut of secondary school and university graduates who have math and science preparation. After all, it is the glut of rock musicians, of lawyers, of coaches, that has created such a fine set of institutions related to music, athletics, and the law.

I think that many of us would agree that the best individuals in each of the three professions are those who work full-time in that profession and are the creative and innovative individuals, whether they are coaching a team, leading a band, or arguing a case. Those professionals who are driving the taxicabs or working in nonrelated fields are those who maybe don't measure up to the highest standards of these fields.

So I want to propose that we move toward creating a glut of math and science students on the secondary level so that we have a larger pool at the university level, so that when we move further ahead in our industries and enlarge our university faculties, we have not only the individuals to fill new positions, but also an adequate supply of secondary school teachers, physicians, and so on. Hopefully, we will at some point have math and science majors driving cabs, a clear indication we have created a glut.

If a math/science glut were to occur, a second major achievement will have occured. Instead of having a citizenry that is illiterate about math and science concepts, we will have a citizenry more informed and attuned to the technology that shapes our society.

For the past 9 years, I have been involved in major efforts to increase the number of underrepresented minorities in engineering, science, and related fields. Through the National Academy of Engineering, major U.S. companies, universities, and other institutions created a coalition that stimulated increased enrollments by designing scholarships, university and secondary school programs.

In the mid-1970's, I recognized that we could never achieve our B.S. graduation goals unless a broader effort was undertaken at the secondary school level. Over the past two decades—while I was a junior high teacher and a university instructor—I heard my more eloquent friends talk about restructuring school finance and everything else, and it still hasn't happened.

So I determined that if I had the opportunity to work with students and with teachers—that opportunity occurred 6 years ago because a number of major California companies and foundations led by the Hewlitt Foundation, companies like Chevron, Arco, TRW, et cetera, decided to take a small high school effort and enlarge it. The objective of that program, which I have headed for the past 6 years, is to graduate high school students with 3 or 4 years of math, science and English, so they can pursue math-based fields of study.

MESA operates in 150 high schools in California, Colorado, New Mexico, and Washington. We have over 4,000 students in MESA. We spend about $390 to $450 per student. In the past few years, we have had 750 high school graduates a year graduating from high school that were previously producing few graduates with adequate math or science preparation.

You have all probably heard about Mr. Jaime Escalante in east Los Angeles whose students were accused of cheating on a calculus test. If he were here today, he would tell you that the only program that helped get students to the calculus point was the MESA program. Many volunteers from Los Angeles companies, university faculties, and Government agencies worked with our students.

In addition to heading the MESA program which is now funded by matches with the State universities and industry, I have also worked with various committees at AAAS, the National Science Foundation, the National Action Council, and Minorities Engineering, and various California companies.

So I have immersed myself in this issue and feel very strongly that there is an approach that I would like to suggest to you in considering the final wording for this bill. I do feel strongly that the Federal Government's participation in this will be a clear signal that it is important, that cooperation is needed. If Federal resources are used to leverage private sector support and the efforts existing in the States, it can be even stronger.

But let me specifically recommend some legislative language that I would like you to consider. First, it would be valuable to indicate that it is necessary to increase the number of secondary school students or university graduates who are completing math and science course or degrees. You can have teachers, you can have equipment, but that doesn't mean you are going to get prepared students out of high school. If there is a quick ecomomic upturn, there is no guarantee that teachers who are retrained or who teach as a result of special scholarships aren't going to do the same thing the previous generation of teachers did. If you increase the salaries, then you are involving yourself in billions of dollars expenditures, given the number of teachers and the amounts it would take to equalize.

By adding the language I have suggested you have a way of measuring whether the investments you make—be they a thimbleful, a bucketful, or a packful—have an effect on the supply. My objective is still to create a glut of students and graduates!

Second, I would look at language where you designate funds and recommend that you invest approximately $15 or $20 million in the existing programs that private industry, foundations, some State agencies, and science museums have initiated.

In the State of California, new investments have been made in math/science education. It is not a hypothetical to ask what California would do with extra money. This year, an additional $22 million was allocated to math and science education. Approximately $12 million went into K through 12 education, a significant portion to teacher training, about $800,000 of that went to the MESA program, the program I direct. Several million went into universities for equipment. There were funds for computer training and adult education. California resources, were not put in one particular basket!

This year, with the election of a new superintendent of schools, Bill Honis, a major thrust is being made in math and science education that far exceeds that amount, provided some other fiscal problems are resolved in that State and other situations occur.

But the point is that major initiatives are underway. And I would like to recommend that the phrasing in you bill consider building on a talent base, the program base that is in place and that is addressing this issue successfully, not only in California, but in other States.

In conclusion, I would like to talk about that lake and that thimble again. We have a lot of agricultural land in California. Years ago, a man wanted to feed his family, and he farmed near one of those lakes. He had a thimble. He would water his small garden with that thimble. A neighbor asked him why he was doing that. Well, I am going to feed my family and, with what is left over, I am going to buy a bucket and I can farm some more. And that is what he did.

He used a bucket, and he farmed a little more land, a few acres. With the excess produce, he began to feed other families. Pretty soon, he had more buckets and he had enough land so that he could put in a pump. The rains—this was not one of those drought periods, and the lake had water in it—and he had a pump. He could farm even more land. So he was not only feeding his family and his neighbors, but he was exporting produce to the East. He got even bigger. You have seen those circles and those huge irrigation projects. Now he is exporting produce to Japan, in addition to the East and feeding his family.

So I think that whether we are going to start out with a thimble or go to a bucket or a pump or a major irrigation system, we have got to have a clear plan. I don't know how long my metaphor will hold out, but I think we need to be clear where we want to go with this. We need to take a number of different approaches so that we end up, not only able to feed ourselves in this math and science arena at the secondary level, but in the economic arenas that are emerging, and we can begin to export not only our goods at a larger level, but also our talent.

Thank you.

The CHAIRMAN. Thank you very much.

I think you both bring some very interesting points together.

Mr. Dimancescu, you mentioned the land grant colleges. That was a case where the Federal Government recognized over 100 years ago the national need and that they could supply land and resources to these institutions to be built to help train, because it was part of the overall good. I think this is just a modest extension of that type of approach that was recognized many, many years ago.

I realize that you don't solve all the ills of the world in one piece of legislation. There are probably people who feel like we have too much money in this bill. There are others, as yourself, who feel like we need additional funds.

I think we must, though, start at—and I don't say that $400 million is a modest level, that is certainly a lot of money—but as you pointed out, when you spread it all over the 50 States, it is not a very significant amount in any one particular location. But I think we must start at a realistic program, and if it has merit, then we can build from that or adjust the program.

I have seen, as well as my colleagues and the citizens have seen, sometimes we put too much money in a program and we wind up with a lot of misuse and not an effective management of the program. So I think we must start at a level somewhere in this ball-park that we are in now. And if it proves successful, we can expand; if it needs changing, we can change it. But we don't create a monster is difficult to change and wind up with the inefficient use of some very finite resources named money, that we have during the economic times that we are facing right today.

That was not intended as a question. It was more of an editorial comment.

Mr. DIMANCESCU. Can I take it as a question, just for a quick answer?

The CHAIRMAN. Sure.

Mr. DIMANCESCU. There are two points which I think deserve extra emphasis. The original Federal participation in the Land Grant Act was also interesting because of the passivity of the Federal role. This wasn't really direct involvement. A lot of people, I think, now fear that kind of involvement from the Federal Government, and the level of financing is another issue.

What is interesting about the precedent is that it was a Federal initiative, but one in which the Federal Government essentially played a passive role, leaving a lot of authority to the States and ultimately to the colleges and institutions themselves.

That is very important as a precedent, I think, because the 1960's and 1970's really have disturbed the public in many ways in believing the only role the Federal Government can play in education is directive, where it is involved, and that it creates bureaucracy and a wasteful initiative in directing the programs. That analogy is wrong.

When it comes to money, I do disagree with you, though. I think, while your measures are conservatively right, and I think you will pass this bill, the problem calls for a large amount of funding, and it is an urgent problem.

The CHAIRMAN. I agree with you.

Mr. Winn.

Mr. WINN. Thank you, Mr. Chairman.

Mr. Chairman, you have made some of the statements that I was going to make. The only thing I can say, Mr. Dimancescu is that if it is going to be a bipartisan effort, you are not going to be able to throw more money at it. This side is not going to do that under the present circumstances. Maybe somewhere later on, we might agree on step 2 and 3. But many of us think that $400 million is too much money at this time.

Thank you.

Mr. DIMANCESCU. I don't want to challenge your political judgment. I think you are probably absolutely right. I have the benefit of being naive by not being involved in the Washington scene. I think I am trying to communicate to you some signals that the national mood is changing on this issue of education and economic growth. Whether the signals translate into an immediate response from you as an individual or the Congress is not clear, but the signals are changing very rapidly, I think.

Mr. WINN. I think they are, but we also sit here year after year and hear educational groups say, "Give us more money, give us more money, give us more money." Maybe as you are going across the country, you might stop in the Midwest and some of the parts other than Massachusetts.

Mr. **Dimancescu**. I have done that.

Mr. **Winn**. That was friendly advice.

The **Chairman**. Mr. MacKay.

Mr. **MacKay**. I was interested, Mr. Dinancescu, in your discussion of the legislation, not necessarily in terms of money, but in terms of the way the problem is defined. What I would like to say is that in the findings, it appears to me that the declaration of crisis is one that defined a $400 million crisis. That is to say that it seems to me that this is an unrealistic statement of what the problem is, and what we should do is state the problem in the terms that you expressed, and then state the fact that we have got $400 million now, so that we don't find ourselves in the ironic position later on when it turns out this really didn't solve the problem of having other people say, "Well, you solved the one you said you solved." I would like your comments on that.

Mr. **Dimancescu**. If I understand you correctly, I think I agree with you. The way I would put it is the findings describe a very large problem and, yet, the mechanics and the funding is very modest. So it creates false expectations, that by stating the findings and providing a small amount of initiative, you will solve the problem. If that is what you said, I agree with you.

You have two choices now. Limit the finding, which is a much more practical statement of the problem, and not create an undue expectation, or keep the finding and enlarge the mechanism and the appropriation or the amounts of moneys being discussed.

Mr. **MacKay**. My concern is that if as the public perception of this problem is translated more realistically—or more generally, let me put it that way—to the legislative body, that we not find this bill as having preempted what we are going to do in this area.

You suggest that the initial Federal role in the land grant system was one that was more passive. By that, you mean they essentially said we will put up as our part of the partnership resources and we will rely on the States to carry out the program implementation. Have you had occasion to review this legislation to see if it is following that approach, or do you see it as being unduly directive?

Mr. **Dimancescu**. To the extent that I understand the title II legislation, to me it would be more directive, in the sense that it puts a lot more research initiative in the Federal hands to define the problem. My judgment would be that the problem is being well defined on a local level, and the two sides need to represent the statement of the problem, not just the Federal one.

Second, the NSF role, I think, is quite directive because it does give the NSF almost total control to determine the priorities. I think that, in my judgment, would be called a directive initiative from the Federal Government. I would much rather argue for a bottoms-up approach where the local setting can define the initiative, particularly where you get this exciting phenomenon of very serious relationships between industry and academia and, in some cases like in North Carolina and others, the State participation, a very good definition of the local problem now looking for the Federal partnership. I don't think that is accounted for well enough in this measure.

Mr. **MacKay**. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. MacKay.

Mr. Lewis.

Mr. LEWIS. Thank you, Mr. Chairman.

Mr. Dimancescu, you pointed out about the bill being a good effort and that it falls short in the amount needed to upgrade equipment, teacher pay, et cetera. The chairman made a statement directed to this, and so did Mr. Winn.

If you have reviewed the bill—and most people who come before committees, both in State legislatures and Congress, there is never enough money they would like to see. The dollars that are provided in the bill, how would you like to see them allocated to do the best job to implement the bill?

Mr. DIMANCESCU. Unfortunately, I can't answer that because the sum is so modest that you can't really do the things that need to be done.

Mr. LEWIS. If there was a start somewhere, where would you start?

Mr. DIMANCESCU. Let's take one example. Harvard University currently has one application for equipment of $50 million. That is just Harvard University alone.

You could look at the University of Minnesota, they tried to put together a CADCAM program from bits and pieces of donated equipment. Just the donation of equipment was $160,000 worth of equipment, but no money to operate and maintain it. That equipment is dispersed through several buildings, and they don't have money for a building. I am sure that if that program were done correctly, you are talking about $3 million or $4 million to do that one program correctly in CADCAM, computer-aided design education.

Those are the kinds of moneys that you are talking about, where one institution could almost absorb all of what you are talking about. So I would have a very hard time knowing how to distribute it.

Mr. LEWIS. That is the point. You have up to $400 million here, and certain areas where you could start prioritizing these things, and you haven't done that.

Mr. DIMANCESCU. Conceptually, I think you have two choices. One choice is to focus those moneys in what are called centers of excellence or specific programs where they can be leveraged to their maximum. The other choice is obviously where you disperse it as widely as possible, to as many people—which I think the $250 million part would be dispersed in that fashion.

I think if you go to the center of excellence course, which is channeling it to a very few efforts, you can probably get a payoff but you sacrifice political interest in the bill. If you go the formula basis, you will have a lot of political interest but a very small long-term payoff from the good that it can do.

Mr. LEWIS. Thank you, Mr. Chairman.

Mr. SIMON [presiding]. Mr. McCandless.

Mr. MCCANDLESS. Thank you, Mr. Chairman.

I would want to lead off by commenting that not all of the farmers in California use thimbles and buckets. We do have some irrigation districts left.

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Mr. **Finnell**. I was talking, sir, about some period long ago, and it led to that development where we have reached the $14 billion economy.

Mr. **McCandless**. I understand, having met with the irrigation district enthusiasts yesterday morning. I want you to know they are alive and well and in Washington seeking funds, I might add, as you are also.

One of the interesting parts about your comment is you almost led me to believe that in California through the resources that you outlined, both private and, to a lesser degree, public, that you have solved the problem and that you don't need this money. How would you respond to that?

Mr. **Finnell**. Take the program that I am working with, for example. We are in 125 high schools, and there are 800 in California. We are operating at the $1.2 million level now. In recent months, I have had meetings with approximately 50 schools that would like to add the program.

So what I am suggesting is that we put together a model that shows that using the existing system, using teachers who are there, using what little lab equipment, textbooks, et cetera, that we can make better use of that system and produce more high school graduates prepared for these fields.

The problem with the teacher training is still there. What I am saying is that it is such a large problem alone in California, if you were to take the fact that one-half of the principals will be retiring within the next 5 years, that in many districts we have math and science teachers who will be retiring, who will replace them? So the cost for retraining teachers, the cost for bringing new teachers in and keeping them there with financial incentives, is a multi-million dollar effort. Superintendent Honick is proposing approximately $800 million for that.

I don't mean to suggest that there is enough money out there right now for it, but I am saying we need to build on the base there, and recognize that with high technology industries, if you create a pool of qualified teachers and their salaries are not adequate, they will drain right out as the teachers in the past did.

Mr. **McCandless**. Maybe the literature here that I have received in abundance since this morning would outline this, but could you very briefly in the time we have available outline to me what it is that we have? When you say we are in a high school, how are we in a high school? What impact do we have? What does the program involve?

Mr. **Finnell**. We have approximately 100 high schools where the principals and teachers have agreed that they would like our program, MESA, to be established. They agree that a teacher will be given time to work with a group of students that are identified and who agree to take math and science and English every semester.

In exchange for that kind of extra effort, we provide with our financial resources tutoring, counseling, summer programs, field trips, study group workshops, so that by the contact that the students have with volunteers from industry or the university, they are stimulated to continue their academic work or, by competing in contests for grades, they can win incentives.

So the objective is for them to complete high school with the option to pursue a math-based field. They win incentives and begin to see that there are rewards for pursuing math-based areas. They have a cooperative network outside of their family and school. So in each high school, we would have from 25 to 80 students—2 percent or 3 percent, depending on the high school—that are receiving the various services that our staff of volunteers provide.

If you then look at high schools—we have had some studies done. The Center for Evaluation at UCLA just completed an independent evaluation of MESA, and they found that we were working with students the way we said we were and additional students were going on to universities with higher SAT scores and preparation better than their peers.

So we are saying that with a partnership of foundations, corporations, universities, whatever resources are there, we can work with students up to a certain point. We have estimated that we can work with about 5,000 students in the State. We are working with about 3,000 now. We think that a percentage of those would go into—well, right now about 67 percent are choosing math-based majors. If we produce a glut, then some will go into high school teaching, et cetera.

Mr. McCandless. Thank you, Mr. Finnell.

Thank you, Mr. Chairman.

Mr. Simon. I have one final question. I regret I was not here when the two of you testified.

We have in this bill, in part B only, a partial emphasis on the foreign language aspect of this whole question. It totally amounts to about 1 percent or probably a little less than the total bill, but it is a lightning rod that seems to be attracting some attention.

We do have a problem in that our scientific and technological exchange tends to be a one-way street because of our language inabilities. Is this a problem that we ought to ignore, or is it a problem that we ought to be including in this legislation, if I may ask both of you?

Mr. Finnell. From the time I was a young boy, I was fluent in both Spanish and English, and I later learned French. I think that it is vital. An educated person, one who wants to compete in business circles, does best speaking in the language of your customers. Certainly the Japanese have that as a cliche. I think that is very important.

As a member of the bay area and the world committee of the World Affairs Counsel of Northern California, we are emphasizing that. Learning a language, whether it is a computer language or another language, is vital.

Mr. Simon. Thank you.

Mr. Dimancescu. My answer would be that, to the extent that you can actually fulfill an expectation of doing something about the problem of languages, then it should be in this bill. If you create an expectation and can't fulfill it with the amounts allocated to it, I think it is wrong.

Commenting on the need itself independent of the bill, I think there is a desperate need for language training training to be reinstilled in the education process. Whether it is in this bill or not, I think, it does require some thought because you do get expectations, and if you can't fulfill them, I think there will be some unsatisfied people.

Mr. SIMON. We thank you very, very much for your testimony and for your willingness to be here and to wait this long to testify.

Mr. DIMANCESCU. Thank you very much.

Mr. FINNELL. Thank you, sir.

Mr. SIMON. Our final panel is Mr. Jack Geils, Mr. Jerry Jasinowski, and Mr. Bill Aldridge.

Mr. Jasinowski, you will be our first commentator. Mr. Jasinowski is the vice president, policy/programs, and chief economist, National Association of Manufacturers. We are pleased to have you with us.

STATEMENTS OF JERRY J. JASINOWSKI, SR., VICE PRESIDENT, PROGRAMS AND POLICY, CHIEF ECONOMIST, NATIONAL ASSOCIATION OF MANUFACTURERS; JACK GEILS, AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES; AND BILL G. ALDRIDGE, NATIONAL SCIENCE TEACHERS ASSOCIATION

Mr. JASINOWSKI. Thank you very much, Mr. Chairman. Mr. Simon, it is nice to be before you again.

I feel a little bit like Barbara Hutton's ninth husband. He knew what he was supposed to do, but he wasn't quite sure how to make it interesting. At this late date, given the abundance of very good information that you have had before you, I would like to ask that my written remarks be submitted for the record. I would like to just make five points briefly that don't go over ground that you have plowed very thoroughly already today.

Mr. SIMON. Without objection, it will be entered in the record.

Mr. JASINOWSKI. The first is to say that the National Association of Manufacturers, as you know, is a 13,000 member industry organization, both small and large. My reason for bringing that up is because it includes both high technology, basic manufacturing, and a certain amount of service industries as well. So we cut across the entire spectrum of American industry.

We feel that this bill is an appropriate step in the right direction to address what is an extraordinarily significant problem for American industry in that broad dimension. You don't need science and technology people in just semiconductor and computer firms. What most people don't realize is that most of our manufacturing firms have a very high technology component, either in terms of what they produce or what they use. For example, over half of what the narrow high-technology firms sell they sell to basic manufacturing. So it is this kind of interrelationship that is very important.

The second point I want to make is that the subject you have before you really goes to a much larger question about the performance of American industry and the economy. And this is an essential part of it. That is to say how we can improve both human capital and technology. But it does cover only a part of it, and you have everything else from plant and equipment investment to international trade policies, finance, and management policies. It is very important to keep that in mind because you are dealing with a much larger set of changes in the American economy and in American industry than this bill can possibly address.

I think that goes to the question of expectations and the question of really what you do here. I am not arguing for a bigger bill. In fact, one of the final points I will make is that you need to be cautious about overextending yourself about which, from everything I have heard this afternoon, there is a fairly genuine consensus in the committee.

But the problem of the industrial crisis or the economic crisis, even when we have a recovery, is that it really requires that we deal with a whole range of policies better than we have done, and this is one important set of them, Mr. Chairman.

My third point is simply to highlight the NAM resolution which you have in the testimony before you, which we passed at our recent board meeting with fairly substantial discussion. It, again, is not anything which I need to take the committee's time on in terms of reading it now, but I would just call your attention to our recognition of the broad range of problems associated with this area, and the expression of concern and the need to move at a number of levels of education, all the way from higher education through basic education.

My fourth point is to direct your attention, Mr. Chairman and the committee members, to the last two pages, which is what government can do and what the private sector can do. I would make two broad points there. The first has to do with the need for cooperation among industry, academia, the government at State and local levels, and to do so in a way that tries to foster that cooperation and maximize the degree of flexibility.

We are past the age when we can simply have a formula grant that spews out money and directs people on how to do things. I know that this committee would not do that. We do need to have in this sophisticated area the maximum amount of flexibility so that, in particular, industry which probably has more to contribute in this area than most others, can play a major role.

When you talk about moving ahead on the cutting edge of technology and innovation in this country, it is in industry for the most part. By providing the environment and flexibility for industry to contribute where I know they want to, I think we will have a more effective final solution to this problem.

My fifth and final point, which is also stressed in the final two pages, has to do with what I think, from what I have heard this afternoon, is already a consensus of this committee. We must avoid an excessive commitment to too much overhead in this bill, instead of getting the scarce moneys that there are out to either improving faculties or improving the capital equipment, and to recognize in so doing that the major mechanism to address this problem will still be the functioning of the marketplace.

I am not here to give you rhetoric about the American free enterprise system, but I don't want you to lose sight of the fact that it is the changing structure of salaries, the changing structure of demand, the operation of hundreds of markets across the country, which will be the primary means by which this problem will be solved.

Having said that, it seems to me appropriate for the committee to address this issue, because the time, the cost, and the difficulties associated with waiting for the market to solve all of the problems is more than we can afford.

So there is an opportunity here for the private sector, government and academia in a carefully crafted way to work together and move forward on this important problem, which is one of several necessary to improve our industrial competitiveness.

Thank you very much, Mr. Chairman.

Mr. SIMON. Thank you.

[The prepared statement of Mr. Jasinowski follows:]

TESTIMONY OF
JERRY J. JASINOWSKI
SENIOR VICE PRESIDENT FOR POLICY AND PROGRAM
AND
CHIEF ECONOMIST
NATIONAL ASSOCIATION OF MANUFACTURERS
BEFORE
HEARINGS OF THE
HOUSE COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
FEBRUARY 16, 1983

I am Jerry J. Jasinowski, NAM Senior Vice President for Policy and Program and Chief Economist.

We commend the Committee for holding these hearings and thank the Chairman and his staff for affording NAM the opportunity to express its concern over the current state of scientific and technical manpower.

The NAM is a voluntary membership organization representing approximately 12,000 member companies which employ a majority of the country's industrial labor force and which produce over 85 per cent of the nation's manufactured goods. The Association is also affiliated with an additional 158,000 businesses through the National Industrial Council and NAM's Association Department.

While scientific and technical manpower issues are clearly important to those manufacturers who produce "high-technology" products, they are also important to any manufacturer who utilizes a process involving a technology-intensive component, or who relies upon a technology-intensive product. I would add that a list of NAM members who fall into either one of these categories would approach a full membership list. Both high-technology and basic manufacturing requires adequate supplies of scientific and technical manpower.

Given this high degree of relevance to NAM members, we would like to suggest some possible options aimed at solving some of the problems in science and engineering education. My testimony here today is intended to present a broad view of the problem, and to evaluate some of the legislative proposals we have before us.

I would like to note here that an effective solution will provide benefits not only to NAM members but will also create significant societal benefits. Improvements in the ability of the manufacturing sector to solve manpower problems will help improve productivity rates, help increase innovation, help U.S. manufacturers compete in the international marketplace, and will assist in providing meaningful employment.

Let me state the obvious. An adequate supply of scientific and engineering personnel is an important condition for the continued growth of American industry. But that doesn't mean it is happening. There exists a growing recognition that the scientific and engineering manpower needs of industry and an increasingly technological society are rapidly outgrowing the current capacity of the academic sector to fulfill them.

What are the problems that industry must face in the coming decade? Personnel shortages exist in many specialties of engineering at different degree levels, in computer sciences and other related disciplines, and in some areas of the physical and biological sciences.

According to National Science Foundation (NSF) figures, bachelor's degree production in science and engineering grew only 5 per cent from 1974-1978; masters degree production grew only 1.5 per cent between 1972 and 1978; and doctorate production actually declined almost 17 per cent from 1973 to 1978. This all occurred at a time when rates of increases in demand for these graduates grew at approximately 3.5 per cent per year.

The most recent NSF figures for 1982 offer little encouragement. In an era in which we expect high growth in the so-called "high-technology" fields, it seems unrealistic to anticipate such expansion without sufficient personnel.

These shortages cannot be viewed as transitory. There is some concern that problems may persist for a decade or more. As Pat Choate, an economist for TRW points out, approximately 75 per cent of our workforce that will exist in 1990 is already employed. One measure of the adequacy of this future supply is the current stock of under-25 scientists and engineers. According to the NSF, this category decreased from 359,000 in 1976 to 212,600 in 1978, a drop of almost 41 per cent (146,700).

Another major problem for industry--a more direct outgrowth of shortages--is the amount of money needed to attract and retain new science and engineering graduates. In the computer sciences new graduates at the bachelor's degree level accept jobs paying "at least $23,000" per year--and offers for other bachelor of science graduates are averaging about $22,500, according to the Wall Street Journal.

The cost of retaining currently employed scientists and engineers has jumped as well, reflecting the supply-demand dynamics of the labor market. Median salary for doctoral scientists and engineers increased from an average of $25,800 in 1977 to $29,434 in 1979, according to NSF. In the chemical industry alone, cost per industrial R&D scientist or engineer nearly doubled from 1969 to 1979, according to Chemical and Engineering News.

The focus of our concern is not simply limited to a statistical description of shortages. Other problems of perhaps even greater significance are created in part by shortages and in part by institutional limitations.

Much less susceptible to quantitative description is the adequacy of our science and engineering workforce. Many students coming out of our schools may not have the background to perform adequately in industry.

To some extent this is a function of the stress that industrial demands have placed upon our educational institutions. Our university system has been unable to produce sharply increased numbers of science and engineering graduates and maintain previous standards.

During the early 1960s, the academic sector experienced unprecedented growth in science and engineering departments, resulting in an at times more-than-adequate supply of graduates to fill industrial demand. Reacting to slackening demand, this positive growth trend did not continue through the 1970s.

Now, in the face of renewed demand, universities are finding themselves unable to adapt quickly. First and foremost among their difficulties are severe faculty shortages. Just like their industry counterparts, universities and colleges are encountering increasing difficulties in attracting and retaining high-quality personnel. Some statistics will indicate the parameters of the problem.

According to a study from the Electronic Industries Association, there are approximately 16,000 full-time engineering teaching positions in this country, of which approximately 1,600 are currently vacant. The study found the highest percentage of unfilled positions in computer science/engineering departments.

Other NSF studies indicate that the proportion of recent doctorates (those holding their degrees for seven years or fewer) in full-time faculty of science and engineering departments in Ph.D.-granting institutions fell from 39 per cent in 1968 to 28 per cent in 1974 and 21 per cent in 1980 - a drop of fully one-half over 1968 and one-fifth over 1974.

Faculty often find that the qualifications that make them desirable in an educational environment create the same demand for their services in an industrial one. The opportunity to work in the private sector and the lure of higher salaries while doing it compound the problem.

This draining of qualified faculty resources from the academic sector to industry increases the difficulty of producing quality science and engineering students. The effect of high industrial demand for the services of faculty merely serves to create pressure for higher salaries in academia--pressure that often cannot be met by a university already financially strapped.

An additional factor inhibiting degree production is the condition of research and teaching equipment in universities. Obsolete instructional apparatus, research facilities and instrumentation reduce the quality of education received and inhibit the ability of colleges and universities to compete with industry for qualified faculty.

The fields for which science and engineering students are being prepared often rank among the most innovative in the industrial sector. In many cases their work will involve the leading edge of industrial knowledge and its application. Yet, according to the NSF, much of the laboratory equipment and facilities for teaching and research were acquired during the 1960s.

One paper prepared for the NSF sought to measure the problem. Underinvestments in engineering facilities, equipment and instrumentation during the 1970s were estimated to approach $750 million in U.S. engineering schools alone. This decreases the attractiveness and effectiveness of academic careers, limiting both available faculty, and ultimately new quality entrants into the workforce.

The problem cannot be simply described as a phenomenon unique to the university level. Significant difficulties are being encountered at the pre-college level. As the EIA study notes, "students who take no math and science after the 10th grade level in high school have effectively eliminated, by the age of sixteen, the possibility of science and engineering as a career...Among high school graduates in 1980, only one-fourth completed enough math and science in tenth to twelfth grade to be eligible for entry to an engineering program."

Many of the pre-college problems are similar to those encountered at the university level. Qualified math and science teachers, through a combination of salary and other environmental factors, are being induced to move to other professions. EIA estimates that, of newly employed science and math teachers in 1981, more than one-half were unqualified to teach math or science.

What Industry Can Do

Industry leaders have delineated six broad areas of interaction that business and industry have with our system of education:

- Business and industry provide a significant "demand-pull" mechanism for our educational system, since they are a principal employer of the products of that system.
- Business and industry provide significant support for our educational system through educational and charitable contributions.
- Business and industry can be suppliers of educational technology. This is especially important as newer forms of educational technologies (such as videotapes and computers) supplant the more traditional forms of communication in the classroom (such as textbooks).

- Business and industry can play a major role in communicating concerns about our educational infrastructure to the public at large, helping influence activities in 16,000 school districts across the country.
- Business and industry (and their trade associations) help aggregate concerns into political constituencies able to support viable solutions.
- Business and industry spend significant amounts on training and retraining, often with little interface with existing educational structures. Increased cooperation can have benefits for both sectors.

In light of the possibilities for industry-academic cooperation, the NAM Board of Directors outlined some broad policy principles in a Science and Engineering Manpower Resolution. The full text reads:

> "The revitalization of U.S. manufacturing and the continued growth of high-technology industries are dependent on the availability of qualified personnel, especially in the scientific and technical disciplines.
>
> The extent and quality of education in mathematics and the sciences at the elementary, secondary and post-secondary levels is a matter of national concern. The situation is aggravated by shortages of qualified school teachers in mathematics and the sciences, and of faculty in universities and colleges, especially in many of the engineering disciplines.
>
> The NAM urges government, academia and manufacturing industry to intensify cooperation in programs to encourage the highest quality of teaching of scientific and technological subjects at the precollege level and promote higher education in the sciences, particularly in engineering."

Essentially, this resolution is an expression of concern--concern over an impending problem and concern over a lack of a coherent, consistent policy. What we need is effective leadership from all involved sectors--public, private and academic. Any legislative attempt at a solution must ensure that opportunities for such combined leadership are encouraged.

What Government Can Do

A successful approach to solving the problems associated with scientific and engineering education requires innovative thought. The six broad areas of industry interaction with the educational system in this country illustrate amply the kinds of unique programs that business and industry can provide. Any legislative solution should allow for all manner of informal, non-govermmental arrangements. I would like to enumerate a set of broad principles which your Committee should keep in mind when it moves forward with this legislation :

- Marketplace dynamics are the primary means to correct the imbalance felt in the labor markets for scientific and engineering personnel. This adjustment, however, will occur over the long run and could have negative repercussions in the interim period for the health of our economy.
- The problems being discussed today cannot be solved through government programs alone. Significant involvement of the private and academic sectors will be required. Reliance on the private sector will require a climate that is conducive to such involvement, including the removal of government impediments and the creation of effective incentives.
- Increased communication and cooperation among all sectors will be needed. There are concerned individuals on the industry side who want to contribute to solutions, and plenty of people on the academic side who need that help--unfortunately, the connection all too often is not made. To allow the greatest possible involvement of the private and academic sectors, any solution must provide for a maximum of flexibility.
- Any program expending funds should strive to reduce the amount of purely administrative costs and should concentrate on funneling resources toward the problem areas they are intended for.
- Existing programs in the public, private and academic sectors should be taken into account to avoid duplication and waste of valuable resources, and to provide for the most efficient use of resources.

> When examining avenues of possible industry involvement in educational programs, overemphasis should not be placed on purely financial relationships. Industry can contribute many kinds of informal aid, often of more use than money. Examples of such aid include lending a scientist or engineer to a school for two or three hours a week to teach a seminar, or opening up a plant facility to students.

Mr. Chairman, members of the Committee, I am grateful for the opportunity to present the views of the NAM on this issue. We look forward to working closely with you and your staff in fashioning a set of policies that will address the issues, and in developing an appropriate legislative vehicle for those policies. Thank you, and I will be happy to respond to any of your questions.

Mr. SIMON. Mr. Jack Geils, American Association of Engineering Societies.

Mr. GEILS. Thank you, Mr. Chairman. It is a pleasure to be here this afternoon.

One of the things I like about your bill is shown on page 16 of my copy where it says "the National Science Foundation is authorized to spend moneys for grants for such research, fellowships, capital equipment, salaries, instrumentation, and other activities as are considered necessary." This is a nice, big, broad target and I like it, as my colleague on this panel has already indicated. We need room to spend the money. We need flexibility, to use Jerry's word, in the way the money is to be applied.

My work currently is in connection with the engineering college faculty shortage situation in the United States. I am speaking for the AAES—an umbrella association of professional societies here this afternoon. The impact of the continuing decline of quality in engineering education and related disciplines is of great concern to us.

In the period 1973 to 1981, undergraduate enrollment in engineering education increased 111 percent, more than doubled. The faculty in place to handle those students increased a mere 11 percent over that same period of time. That situation—in the 18 months I have been on the job here in Washington—is very difficult to turn around in a short period of time. While we have made some effort to publicize and bring attention to the problem of the engineering college faculty shortage, we haven't solved the problem, by any means.

The engineering education delivery system, which is designed to turn out 40,000 undergraduates a year, is now turning out 67,000. That is a 68-percent overload. What is happening is in the quality of engineering education. The quality is definitely decaying.

It is essential to differentiate the engineering college faculty shortage situation from the shortage of engineering manpower in general. The supply of bachelor's level, master's levels and Ph. D.

candidates each year are gobbled up by industry, as you all know, and gobbled up somewhat independent of the economy. The economy may go from boom to bust, but the demand for engineering graduates goes from boom to just a little below boom.

The point is that in a highly technical society, growing more technical everyday—and you heard testimony earlier this afternoon from the computer side—the point is that our society needs a continuing supply of quality engineers. I am here to stress quality.

In this business of engineers and unemployment, for example, even at the worst possible time since World War II, unemployment rates for engineers rarely approached 2 percent, and perhaps never did.

Current conditions in our engineering schools seriously threaten the quality of our future engineers. I have served for the past year on a Committee on the Quality of Engineering Education sponsored by the National Association of State Universities and Land-Grant Colleges, and a report which is available to any or all who would like to see it on the quality of engineering education just made recently states that: One, the U.S. engineering education system has experienced a serious decline in quality in the last few years; two, the root causes of the quality decline are overenrolled classes, obsolete equipment, equipment shortages, insufficient space and a persistent shortage of faculty; three, many young people choose not to pursue academic careers because of noncompetitive salaries and poor working conditions; and four, even should a decline occur in the popularity of engineering as a college option, the Nation will require a continuous supply of engineers at a level substantially higher than that of the past 5 or 10 years.

In conclusions and recommendations of this committee on quality, two of them stand out. One says that a major national program is needed to increase the size of the resource base for engineering schools, including faculty, teaching assistants, support staff, equipment and space. Such a program is well beyond the means of universities to handle alone, and it is now clear that universities and industry, working together, can provide only a portion of the support needed. A major infusion of supplementary funding is required from State and Federal Governments.

Another recommendation is that a program to increase the present Ph. D. output by 1,000 graduates per year is urgently needed, coming from the top of their undergraduate class, and should be implemented without delay. The Federal Government should be encouraged to provide strong leadership for this program of national impact.

We are currently turning out 2,887 Ph. D. degrees in engineering a year. Over 40 percent of them are to foreign nationals. Many do not remain in the country; those who do often have difficulty in handling the language and being effective teachers. So we need to beef up the supply of U.S. citizen Ph. D. candidates in engineering.

My project sponsored a survey of engineering faculty and graduate students. The most recent survey published last fall showed that one quarter of all assistant professor authorized openings were unfilled and that nearly 60 percent of those had been unfilled for over 1 year. This is an entry level to the teaching profession requiring a Ph. D. degree. Those openings at assistant professor, the entry level, represent almost 60 percent of the openings in the colleges and universities of the Nation at this time.

The National Society of Professional Engineers authorized a survey on the laboratory equipment factor, and this survey shows that an impossible $2.2 billion should have been spent in the last decade to bring existing and required instructional labs to the state-of-the-art level.

Last summer, the Engineering Deans Council of the American Society for Engineering Education passed a resolution urging curtailment of enrollment in the Nation's engineering schools to effect a balance with the resources that are in place in order to restore quality engineering education.

Surveys of the Nation's engineering colleges in 1981—based on 1980 data—and again in 1982—based on 1981 data—revealed that the number of unfilled budgeted faculty positions out of a total of roughly 18,000 decreased slightly from 9.8 percent to 9 percent. It is important to note that these figures say nothing about the number of faculty members there should be in the engineering colleges to insure the quality of engineering education we are talking about. Engineering faculty are grossly overloaded. But university administrations are understandably reluctant to authorize additional budget positions when those currently available cannot be filled. We can't fill the 1,600 or so that are vacant today.

One measure of the deteriorating situation in engineering classrooms and laboratories is the increase in recent years in the ratio of students to faculty. While the absolute value of this ratio required for quality instruction is open to debate, there is no question that engineering education, with its heavy emphasis on laboratory instruction, is particularly sensitive to the need for frequent student faculty interaction. It is instructive to compare the student faculty ratio of the late 1960's—at that time, engineering colleges were producing very high quality graduates—with the ratio today, a time of heavy student load for the faculty.

To lower the 1981-82 student faculty ratio to that of the late 1960's would require, not 18,000 faculty positions now authorized, but 23,100 such positions. So the engineering college faculty shortage is not just the 1,650 unfilled positions, but rather more like 6,750 new faculty that are needed to provide quality education.

With deteriorating quality of undergraduate education and a totally inadequate supply of Ph. D's in our graduate schools, no real faculty or equipment relief is on the horizon. And every conceivable effort must be undertaken immediately by every unit in industry, government, and academe. Clearly it is imperative to provide systems including funding to modernize our laboratories and to support graduate students and young, untenured faculty.

I commend you, Mr. Chairman, for the efforts of H.R. 1310 to address this problem. It provides a valuable base. We are excited about it. My 42 years of employment with AT&T and the Bell System has taught me to respect large numbers. I would urge your appropriations to exceed $100 million a year for 5 years if possible. After all, in the Bell System, we spend $1.7 billion a year on education and training for our 1 million employees. So don't be too tight about the amount of money that you offer.

We are particularly supportive of the matching provisions of the bill. Industry, academe, and State governments have an important role to play in addressing these problems. We have produced a catalog—as a result of our work on our project here in Washington—of industry initiatives and actions. We have produced a catalog of State initiatives and actions. Things are beginning to look up, but we are a long way from making the progress that really needs to be made.

We recommend that the language be changed to recognize in-kind contributions as part or all of the required matches. Though hardware, perhaps, should be the preferred in-kind contribution, related software and suitable maintenance contracts should also be included. Today's sophisticated personal computers are an essential tool for the science, engineering, and technical student, but are quite useless unless they are backed up with appropriate software and ongoing maintenance. Dr. Florio made this point earlier in his remarks also.

We like the built-in flexibility of the fund to respond to individual priorities of colleges and universities. We do hope that the fund will be targeted to projects which will provide computer and similar instructional equipment, support for untenured faculty members and, of course, for graduate fellowships, if possible.

In conclusion, Mr. Chairman, we offer you any assistance we can provide, and hope you will consider these modifications seriously.

Thank you.

Mr. Simon. We thank you.

I might just underscore one of your points. I was asking questions about foreign languages when we had the noon recess. Someone came up to me in jest, but said we had to have foreign languages for students to understand the faculty members. Well, it was said in jest, but it carries a point, unfortunately.

Mr. Geils. Quite true.

[The prepared statement of Mr. Geils follows:]

TESTIMONY OF THE AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES

Mr. Chairman, Members of the Committee, I am pleased to appear before you this morning to comment on H.R. 1310. I am John Warren Geils, Staff Executive of the American Society of Engineering Education (ASEE). I direct the Engineering College Faculty Shortage Project (ECFSP), a joint venture of the ASEE, the American Association of Engineering Societies (AAES) and 11 corporations. The latter provide the funding, and they are: AT&T, DuPont, EXXON, GE, GM, GTE, Hewlett-Packard, IBM, Rockwell International, Union Carbide and Weinschel Engineering. I am testifying today on behalf of the American Association of Engineering Societies, an umbrella organization of 43 professional societies representing nearly one million engineers. I would like to express my appreciation for the opportunity to testify today, as I believe very strongly in the necessity of government partnership with industry and academe if we are to impact the continuing decline of education in engineering and related disciplines.

Eighteen months ago I came to Washington to head this two-year project aimed at solving the engineering college faculty shortage problem. Now I can safely say it is not solved. We are not even close to solving it, and it is essential to differentiate it from the related issue of engineering manpower supply. Quality rather than quantity is the key issue. We cannot afford to further jeopardize the quality of our future engineers by ignoring faculty, facility and laboratory equipment deficiencies. The need for adequately educated engineers exists independent of manpower demand cycles; even assuming the lowest possible demand for engineering graduates, the necessity for high-quality engineers continues.

The impact of technology on the American economy and on American living is relentless; every day our lives are affected in some new way by the increasingly complex applications of innovative technology to our industrial and domestic tools, transportation systems, agricultural and water systems, defense systems, communication systems, energy systems, etc. The key point is that these applications are the work of engineers -- not scientists. The engineer applies the new knowledge created by scientists in a practical way via designs of new and improved structures, products and services. Thus, as technology multiplies, increasing the quality of engineers is vital to the nation's well-being.

Current conditions of our engineering schools seriously threaten the quality of our future engineers. I have recently served on a Committee on the Quality of Engineering Education.* A recent report by that Committee points out:

1) The U.S. engineering education system has experienced a serious decline in quality in the last few years;
2) The root causes of the quality decline are over-enrolled classes, obsolete equipment, equipment shortages, insufficient space, and a persistent shortage of faculty;
3) Many young people choose not to pursue academic careers because of non-competitive salaries and poor working conditions;
4) Even should a decline occur in the popularity of engineering as a college option, the nation will require a continuous supply of engineers at a level substantially higher than that of five or ten years ago.

* Sponsored by the Commission on Education for the Engineering Professions, National Association of State Universities and Land Grant Colleges

The Fall 1981 Survey of Engineering Faculty and Graduate Students by the ECFSP Project showed that 1/4 of all Assistant Professor (entry level, Ph.D) authorized openings were unfilled and that nearly 60 percent of them had been unfilled for over one year. The National Society of Professional Engineers' survey (9/82) on "The Laboratory Equipment Factor" showed that an impossible $2.2 billion should have been spent in the last decade to bring existing and required instructional labs to the state-of-the-art level. Last summer the Engineering Deans Council of the American Society for Engineering Education passed a resolution urging curtailment of enrollment in the nation's engineering schools to effect a balance with resources in order to restore quality education.

Surveys of the nation's engineering colleges in 1981 and again in 1982 revealed that the number of unfilled budgeted faculty positions, out of a total of roughly 18,000, decreased slightly from about 10 percent to 9.1 percent. It is important to note, however, that these figures say nothing about the number of faculty members there should be in the engineering colleges to insure that the quality of engineering education is at least on a par with that of earlier days of unquestioned U.S. leadership in essentially all areas of technology. Engineering faculty are grossly overloaded today, but university administrations are understandably reluctant to authorize additional budgeted positions when those currently available cannot be filled.

One measure of the deteriorating situation in engineering classrooms and laboratories is the increase in recent years in the ratio of students to faculty. While the absolute value of this ratio required for quality instruction is open to debate, there is no question that engineering education with its heavy emphasis on laboratory instruction is particularly sensitive to the need for frequent student/faculty interaction. It is then instructive to compare the student/faculty ratio in the late 1960's, (a time when engineering colleges were producing very high-quality graduates for industrial and defense needs of the nation) with that of today (a time of heavy student load for the faculty.) To lower the 1981-82 student/faculty ratio to that of 1968-69 would require not the 18,000 positions now authorized in the engineering colleges, but rather 23,100 positions. So the engineering college faculty shortage is not just the 1,650 unfilled positions found in the most recent survey, but rather approximately 6,750 new faculty needed to provide quality education.

With deteriorating quality of undergraduate education and totally inadequate supply of Ph.D's in our graduate schools, and no real faculty or equipment relief on the horizon, every conceivable effort must be undertaken immediately by every unit in industry, government and academe. Clearly, it is imperative to provide systems to modernize our laboratories and support graduate students and young, untenured faculty.

Mr. Chairman and Members of the Committee, I commend you for your efforts to address this problem. I am especially pleased that you were able to work out a compromise with your colleagues on the Education and Labor Committee. H.R. 1310 provides a valuable base for attacking the nation's ills concerning science, math, engineering and technology education. While the engineering community recognizes the importance of the entire Bill, our interest lies mainly in Title II. Our specific comments will focus on that Title.

There are manpower shortages in specific areas in science, engineering and technology. However, faculty, facilities and equipment shortages are far more pervasive in the engineering arena, and I would urge the Committee to consider amending Title II to reflect this emphasis on quality rather than quantity. For example, Secs. 202(2) and 203(a) refer to "a pressing need for trained technicians" and an "adequate supply of personnel." I would recommend instead the language "adequately educated and trained technicians/supply of personnel." I would be happy to work with you to make these and other similar modifications.

We are particularly supportive of the matching provision of the Bill. Industry, academe and state governments have an important role to play in addressing these problems, and are appropriately involved through matching grants. To maximize the effectiveness of the Fund, I would suggest the addition of a provision explicitly requiring institutions to arrange for the local matching support. By placing the burden on colleges and universities to establish relationships with non-Federal sources of support, the Bill serves the important function of facilitating community-based partnerships. In addition, I recommend that language be added to recognize in-kind contributions as part or all of the required match. Though hardware should be the preferred contribution, related software and maintenance contracts should also be included. Today's sophisticated personal computers are an essential tool for the science, engineering and technical student, but are quite useless unless backed up with appropriate software and on-going maintenance.

Also, we support the built-in flexibility of the Fund to respond to individual priorities of colleges and universities. However, we hope the Committee will target the limited dollars of the H.R. 1310 to particular problems in the national interest. Specifically, we recommend the Fund be targeted to projects which provide computer and other instructional equipment, support for young, untenured faculty members, and for graduate fellowships.

In conclusion, Mr. Chairman, I offer you any assistance we can provide, and hope you will consider the modifications we have described.

Mr. SIMON. Our final witness, saving the best until last, is Mr. Bill G. Aldridge of the National Science Teachers Association.

Mr. ALDRIDGE. Thank you, Mr. Chairman, for the invitation to appear before the committee.

I come representing not just the National Science Teachers Association, but also the American Association of Physics Teachers, the National Association of Biology Teachers, and the National Association of Geology Teachers. We represent the professional aspects of science teachers at all levels, not the welfare aspects.

We are very much concerned with the problems which have been identified and, I believe, led to the hearings which you are now conducting and the hearings which I have sat through previously before the Education and Labor Committee.

I would like just to very briefly summarize our testimony and ask that the written version be inserted into the record.

Mr. SIMON. It will be.

Mr. ALDRIDGE. Thank you.

What I would like to do is to try to again focus your attention on the problems as we see them and to comment very briefly on the bill itself and, finally, to make a few general comments and some specific recommendations, just to quickly summarize the problem again, because it seems to have been lost.

Except for engineering, I know of no area in which there is a crisis today in the United States in science and engineering education, outside of the problems at the secondary school level. I believe that a series of problems are responsible for what is happening in those schools.

Let me list those quickly: an insufficient supply of qualified science and mathematics teachers at the secondary level, underqualified and unqualified math and science teachers in the classrooms—and that number, by the way, is roughly 30 percent of all of the math and science teachers in the United States—and finally, an item which has not been considered either in this bill or in any other bill that I have seen among the 17 that were introduced in the last session of Congress or the 11 that have been introduced so far in this session, the completely obsolete content of courses at the secondary school level in the science subjects and in the instructional materials used to support them.

Specifically, I am talking about the fact that we have courses which were developed in the 1960's, designed for people who would become scientists and engineers, but not designed for anyone else and not meeting the needs of anyone else, still in the schools. I hear lots of talk about offering the same thing to more kids, and that is not the solution to the problem.

In addition, even those courses are obsolete for those who would become scientists and engineers. Such courses lack any reference to computing, or modern microelectronics, and more of the practical applications that people need.

So those are the problems. Two of the three items are being addressed somewhat in the legislation which is being proposed.

Let me make some brief comments about the legislation. The various inservice teacher training programs will address the problems we have identified and may do something to help resolve them. The national teaching scholarships will help a great deal to improve the image of teaching at the secondary school level. The image problem is far more serious, in my judgment, than the salary problem.

When you improve the image of teaching, you will get dedicated people going into those fields. Many of us went into teaching in the 1950's when salaries were very low. We did it because we wanted to do something important, not because we wanted to earn money. There are many young people out there today who will do the same thing if what they are aspiring to do is recognized as something which is important to society and if they are treated like human beings in the classrooms and in the schools.

There are aspects of the bill—let me refer specifically to the bill that was handled by Education and Labor—part B in particular, that we are very much concerned about. We do not believe, for example, that you can carry out research or development in science education in an agency which is isolated from the scientific community. Nor do we believe that you can do these tasks in an agency which has become politicized. We believe that that constitutes a very serious threat to getting quality work done for the money that you are going to put into it. You do not have that problem at the National Science Foundation, and I don't believe you will have.

Let me go to title II of the legislation. You have already a $1 billion appropriation at the National Science Foundation for many of the concerns expressed in title II of the bill before this committee. What I see is another $100 million being added to a National Science Foundation budget of $1 billion which is already being proposed to increase by 18 percent by the administration. So here is a 10-percent increase to an already 18-percent increased budget, and I see essentially nothing being done about the problems for which there really is a crisis; namely, the problems of science and engineering education, particularly at the secondary school level.

I realize that it has been this committee which has imposed upon the National Science Foundation the programs of the past which did anything at all in this area. We commend you for that.

The problem that we feel exists is one associated with the National Science Board. You have a board which is not representative of the missions of the agency. As a direct consequence of that representation, you have policies which are not responsive to the Organic Act which set up the Foundation.

Let me make just a couple of general comments, and then I will try to conclude.

Improving course content is absolutely essential at the secondary school level if you are going to improve the situation there. You can't just generate more teachers. You can't just improve the qualifications of those teachers who are in the schools. Nor can you put more materials in their hands unless you do something about the courses.

You cannot do that in 16,000 local school districts. It is inefficient, it is wasteful, and you cannot find the concentration of scientific talent, educational knowledge, and the kind of effort needed to achieve good results. What you will end up with at the local level if you attempt to design curriculum or materials there is creationism materials being produced and you will have local schools doing things which have nothing to do with the goals of science education. That is the problem you are going to face.

There are a couple of aspects to the bill that I would like to comment on in regard to allocation and matching requirements. I am amused when I hear someone talk about the desirability of having matching requirements, when the defense siphon is generating extraordinary amounts of defense related income to the industries of that State at the same time that the taxpayers are paying somewhat less into the Federal Government. Those same States, like North Carolina, like California, don't have too much trouble coming up with matching money.

Well, how is Bethlehem Steel going to do in this regard? How are we going to do with Ohio and Michigan and some of the other States that simply don't have these kinds of resources available? What about General Motors, for example in Michigan? Are they going to be able to come up with some funding to help match the money which is needed in Michigan so desperately to take care of the fact that half of their schools don't have a physics teacher at all?

So I really have some serious problems with the cost sharing and the matching provisions of the bill.

Finally, let me comment on the so-called magnet and model schools. Cecily Selby once suggested to me that she had hoped that when they set up the North Carolina school that they would select students at random, because it is one thing to go in spending eight times as much for instructional personnel and do it with the best students you can find, and it is quite another to do it with a cross-section of kids that you are going to get in every school in the country.

So if you want a model, set up a system that will bring a cross-section of children into a school and make it excellent, and see if you can do something there. Anybody can teach the bright and the gifted. I have done that. I can tell you that they learn without much help. It takes a great deal more to teach the rest of the population, and a great deal more in the way of resources.

Let me make one final comment. I am taking this from a comment that was made by David Stockman in his article in the Atlantic Monthly in regard to the tax bill. We start out with a problem having to do with science education at the secondary school level, a crisis, if you will. What I have seen in the days that I sat before the committees are "hogs eating at the trough". The moneys that you have available in this bill are sufficient to do a great deal toward solving the problem, but they are being dispersed in ways which will not address the problem properly.

We have made some very specific recommendations in our testimony on page 6. I would urge you to examine that page and to act on it.

I guess the only other comment is the National Science Teachers Association is the principal source of data that has documented this crisis. To my knowledge, there is no other prime source. There are plenty of secondary sources. I would add that we did that with $12,000 of our own money. I find that amusing when I look at the moneys available to the National Center of Education Statistics and the science resource studies program at NSF, neither of which have gathered any information whatsoever on this crisis.

Thank you.

Mr. VOLKMER [presiding]. Thank you very much, Mr. Aldridge.

[The prepared statement of Mr. Aldridge follows:]

PRESENTED BY: BILL G. ALDRIDGE, EXECUTIVE DIRECTOR, NATIONAL SCIENCE TEACHERS ASSOCIATION

Bill Aldridge took dual undergraduate majors in physics and science education. He then taught high school physics and math for six years. After completing three graduate degrees in solid state physics, educational evaluation and science education at Kansas and Harvard, he taught physics at the college level for seventeen years.

Mr. Aldridge has directed three NSF course development projects in applied physics, technology, and modern electronics (including computers). In addition, he served a three-year assignment (1976-1979) from his college to the Division of Science Education Development and Research at NSF as a Program Manager before taking his present position as Executive Director of the National Science Teachers Association. Mr. Aldridge has published science and math textbooks and numerous articles in magazines and journals. He has served in a variety of capacities on advisory boards, committees, etc., and he is currently a member of the Scientific Manpower Commission. The National Science Teachers Association, which he directs, is the largest science education organization in the world, and it is concerned with the professional aspects of science teaching at all levels.

INTRODUCTION

It hardly seems necessary to document the pre-college science and mathematics education crisis which is addressed by H.R. 1310. As the primary source of data on the crisis, the National Science Teachers Association has been deluged with requests for detailed information and suggestions for solutions.

The data have been collected by NSTA through three different surveys conducted over the past two years. As a consequence of this activity, and through discussions among leading science education experts, the crisis in elementary and secondary school science and mathematics education can be summarized as follows:

1. There are shortages of qualified secondary school science and mathematics teachers. The shortage is critical in mathematics and in physics;

2. There is a serious mismatch between existing secondary school science and mathematics course content and the needs and interests of the vast majority of students;

3. There have been few attempts to alter instruction in schools in ways consistent with the growing body of new knowledge about learning/teaching science.

4. Supplies, equipment, and other resource materials are severely limited or obsolete in most science classrooms and laboratories; those that exist are inappropriate to science courses and teaching strategies needed today.

5. Science content is nearly nonexistent in elementary school offerings. Teachers are ill-prepared, resources are lacking, and the focus is on the so-called "basics" which have tended to ignore science.

The Shortage of Science and Mathematics Teachers

The shortage of science and mathematics teachers is documented by looking at supply and demand. The fall 1981 NSTA survey of 600 colleges and universities whih prepare science and mathematics teachers showed a shocking ten-year decline: a 79 percent decline for mathematics and a 64 percent decline for science. (See attached paper by Shymansky and Aldridge.) Data from the fall 1982 survey show a further decline. (See attached graph.)

The demand for science and mathematics teachers has been documented by Howe and Gerlovich at Iowa State in surveys of state science supervisors. NSTA derived demand data from surveys of secondary school principals. Our fall 1982 survey showed that secondary schools employed 6% *more* science and mathematics teachers in 1982-1983 than in the previous year. With widespread calls for increased requirements for science and mathematics in high school, we can expect further increases in the demand.

Now, if the supply has dropped so drastically, how can the schools be finding teachers to fill classes? They have been employing *unqualified* or *underqualified* teachers. Hiring such teachers is made possible through provisional or emergency certification, or through extremely low certification standards. The emergency measures have made possible the reassignment of teachers from physical education, home economics, social science, elementary education, and other fields where surpluses exist. A more common problem is transferring teachers within science, that is, from biology to chemistry and physics, without sufficient qualifications in those subjects.

When promising but underqualified teachers are taken from the elementary school and reassigned to secondary schools, the situation is doubly tragic. The secondary school science or mathematics students are instructed by an unqualified teacher while the elementary school students lose a teacher with promise in mathematics or science. The situation at the elementary school level is especially serious, and we need teachers at that level with interest in and some knowledge of science or mathematics.

Committee members may be aware of an example in Montgomery County, Maryland, one of the wealthiest school districts in the nation. (See THE WASHINGTON POST, January 16, 1983, page B8.) Their solution to the shortage of mathematics teachers at the secondary level was to offer a quick workshop dealing with basic mathematics for interested elementary school teachers. Then these teachers, so badly needed at the elementary level, would be placed in secondary school mathematics classrooms, where they would be clearly underqualified. This is a wealthy school district! One can only lament what must be happening to students in poorer districts in this country.

Principals are faced with an overall declining secondary school enrollment, a surplus of teachers in some areas, and a shortage of science and mathematics teachers. Who can blame a principal who reassigns a long-time faculty member from a non-science field into a science or math slot when no qualified teacher can be found? Moreover, even if a qualified person were available, tight budgets and teachers' contracts may preclude a principal from hiring a new staff member; thus the principal is forced to meet the need through staff reassignment.

The demand for science and mathematics teachers is even greater than indicated by open positions. According to NSTA's fall 1982 survey results, for lack of teachers and/or resources, some 12,000 classes in science and mathematics which were needed, could not be scheduled in 1982-1983. Instead, some 640,000 children who wanted to take science or mathematics were required instead to take courses in other subjects for which no teacher shortage existed.

The Outdated Curriculum

The lack of sufficient numbers of trained teachers is compounded by the mismatch between science and mathematics curricula and the needs and interests of students.

The science and mathematics curricula in U.S. schools today are, for the most part, only slightly modified versions of the spectacular curricula developed after Sputnik by teams of scientists and teachers. Yet, as Jerrold Zacharias, MIT physicist, and originator and developer of one of the first National Science Foundation curriculum projects, PSSC Physics, said,

> "We had aimed only at the college-bound and college students because we could not do everything at once" (in testimony before the Subcommittee on Science, Research, and Technology of the Science and Technology Committee on February 19, 1980).

These curricula neglect the needs and interests of the vast majority of students. They focus on pure science and are largely devoid of practical applications, technology, or the relevancy of science to society's problems such as acid rain, nuclear wastes and disposal, improper nutrition and so forth. They do not prepare people to enter the myriad of non-science occupations, which require technological knowledge for which science is the base for real understanding. Nor do these curricula properly take into account the utilization of the computer and modern electronics. Technically well-trained people are needed by emerging or rebuilding industries to solve the economic problems we face.

The curricula in most schools are curricula of the 60's, and they are obsolete!

New Instructional Strategies

The last ten years have provided much new information concerning the way humans learn. The current literature suggests exciting new information concerning the adolescent mind, and how it grows and develops. Information from studies in cognitive psychology need to be applied in school science classrooms. Further, new views of the nature of science and the many dimensions that can be studied are being reported. These studies suggest new approaches to instruction, and new ways for science teachers to approach their tasks. Use of the current research is needed as teachers are retrained, and all too few new teachers complete preparatory programs to gain certification.

Why Research, Development, and Teacher Training Programs Should be Lodged at NSF

The National Science Teachers Association is impatient with National Science Board policies which lack appropriate science education initiatives at NSF. Yet we retain the strong conviction that science and mathematics education programs that are to be administered at the federal level must be lodged at NSF.

Jerrold Zacharias, in his testimony of February 19, 1980, stated the problem at NSF well:

> "...the Education Directorate [at NSF] is struggling against an almost impossible enemy - an enemy from within. From its inception the Science Board [NSB] that supervises the NSF has treated the Education Directorate as a trivial country cousin. They have said that the government should give the NSF money for scientific research and never mind what happens to the two hundred million people who don't do research. It is those very people whose lives, jobs, leisure, entertainment, food, security, and everything else depend on a sound economy in a democratic society. The Federal government can no longer allow itself to neglect the schools, and the NSF has in its charter the responsibility and authority to do something about them."

That responsibility and authority is described in Public Law 507-81st Congress (64 STAT. 149, S. 147), Section 3.(2):

> "The Foundation is authorized and directed - (1) to initiate and support ... science education programs at all levels..."

In spite of lack of action on the part of the National Science Board in carrying out this statutory obligation, we in science education continue to believe firmly that the original reasons for lodging science education programs at NSF are still valid and important:

We must develop science and mathematics education materials and train our teachers in a partnership with those scientists who create the knowledge.

That knowledge, and the methods used by scientists to acquire new knowledge, are constantly changing. Science and mathematics teachers need direct, cooperative relationships with scientists and mathematicians, and involvement of research scientists in science education is essential. There are other compelling reasons why such programs should not be administered at the Department of Education and should, instead, be placed at NSF. The NSF is a small independent agency with a reputation for administering programs of very high quality selected on merit, with a minimum of political interference. The Department of Education is well-known as an enormous bureaucracy, where awards are too often granted as allocations or entitlements, and where political factors play far too great a role in funding decisions. It is especially distressing that the present Administration has permitted the advisory and management components of the Department of Education to become politicized, and not just with members of their own party, or with conservatives, which would be understandable. But allowing the agency to become politicized with ideologues of the far right who often lack even the most basic education or experience relevant to the job requirements is very destructive of fair, proper, and efficient administration of government programs. The NSF has, for the most part, been able to retain its status as an independent agency. Also, the scientific community would never permit NSF to be politicized like the Department of Education.

Even though the National Science Board has been slow to respond to the present crisis, as indicated by the lack of NSF initiatives, scientists at universities and in the private sector, as well as those at the AAAS and the National Academy of Sciences, have shown great interest and concern. Many of these persons are actively working to improve the situation.

The NSF course development projects of the 60's were excellent for their purpose. They developed courses, materials, and labs to prepare persons who would become research scientists and engineers. Until they became obsolete—which they did about ten years ago—these courses were excellent. But what has evolved into essentially all existing physics, chemistry, earth science, and biology courses and texts are now (1) obsolete and (2) inappropriate to the needs of the vast majority of students.

We badly need to upgrade, redesign, and recreate courses for the present. No publisher can afford to do this. Furthermore, you cannot do it through 17,000 course development efforts in 17,000 school districts. You will not have the necessary concentration of talent, both educational and scientific. Nor will you be able to provide enough money. You will end up with inferior materials which will further degrade our system.

We desperately need national course development efforts with teams of scientists, science teachers, and science educators and learning specialists, working in cooperation with publishers, equipment manufacturers, and computer and software companies. These course development projects should design courses with applications and labs that use modern microelectronics and computers.

Although there are numerous activities that are appropriate to Local Education Agencies and State Education Agencies, and we support funding those activities, research and development belong at the national level.

In science and math these efforts should be at NSF, the agency with authorization for these functions in its enabling legislation. We must have the assistance and support of research scientists, if our courses are to be valid and appropriate.

States can worry about scholarships, loans, personnel requirements, etc., and funding for these functions for State Education Agencies is encouraged. One useful state activity would be science education "agents" to visit schools like county agricultural "agents" from land grant colleges.

Local schools can work with universities, museums, and industry to provide some in-service education and to assess their science and math needs. They can build curricula by selecting from available courses and materials. They can also adapt materials to their particular needs. These activities, too, are worthy of support.

The NSF has the staff, the organization, and the experience in research, development, teacher institutes, and undergraduate programs. Even with the severe reductions of staff in science education, many remain who were associated with development, course improvement, teacher education, and public understanding of science. The NSF has offered important programs through TV (3-2-1 Contact, NOVA, etc.), science museums, and other media to inform and educate both youth and adults in science education.

Cost-Sharing Provisions

Although cost-sharing provisions are appropriate for some parts of H.R. 1310, this aspect of the Bill should be made much more flexible.

Research and Development, funded by NSF, should have precisely the same requirements of cost-sharing as in the basic research and development programs. Summer institutes, academic-year institutes, and similar teacher training or upgrading programs should have a cost-sharing requirement of not more than 1/3. Otherwise, the program will simply give greater wealth to the already wealthy—greater advantage to the advantaged!

Programs for regular in-service education, assessment, and equipment or materials acquisition should be on a 50-50 cost-sharing basis.

Specific Recommendations

1) Local Education Agencies

We recommend funding as proposed in H.R. 1310 except for provisions involving course or materials development at the local level.

2) State Education Agencies

We recommend funding as proposed in H.R. 1310.

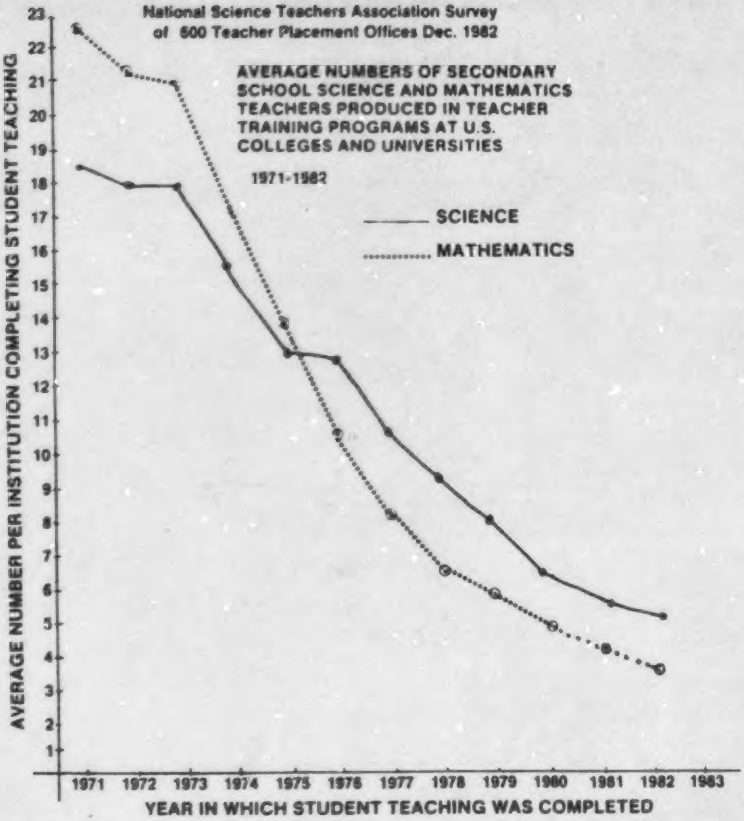
3) Federal Agencies

All course and materials development, teacher institutes, and science education research should be lodged at the National Science Foundation.

Program Recommendations for NSF Component of H.R. 1310

In addition to the $100 million included in H.R. 1310 for NSF, it is proposed that the $50 million designated for post-secondary programs at the Department of Education be allocated to NSF. This $150 million would offer a reasonable level of funding for science and engineering education programs at all levels. The funds could best be allocated as follows (in $ million):

Undergraduate Science, Math, & Engineering Education		
Research and Development Program	13	
Instructional and Laboratory Equipment	20	
Personnel Improvement	25	
	58	
Pre-College Science, Math, & Engineering Education		
Science Education Research Program	5	
Course Development Program	30	
Public Science Program (TV, film, etc.)	5	
Computer Utilization Program	15	
Teacher Institutes Program	35	
Personnel & Resource Studies Program	2	
	92	
		150


National Science Teachers Association Survey
of 600 Teacher Placement Offices Dec. 1982
AVERAGE NUMBERS OF SECONDARY SCHOOL SCIENCE AND MATHEMATICS TEACHERS PRODUCED IN TEACHER TRAINING PROGRAMS AT U.S. COLLEGES AND UNIVERSITIES
1971-1982
SCIENCE
MATHEMATICS
AVERAGE NUMBER PER INSTITUTION COMPLETING STUDENT TEACHING
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
YEAR IN WHICH STUDENT TEACHING WAS COMPLETED

The Teacher Crisis in Secondary School Science and Mathematics

Science and mathematics instruction is deteriorating as fewer teachers pursue careers in these fields.

JAMES A. SHYMANSKY AND BILL G. ALDRIDGE

Our nation faces unprecedented problems in science and engineering education, the most severe of which is the critical shortage of qualified science and mathematics teachers at the secondary level. The problem is not new. Studies by the National Education Association (1981), Howe and Gerlovich (1982), and Akin (1980) have carried this message for several years. Yet school goes on. Is the problem not as severe as the data suggest, or worse than we realize?

We recently conducted surveys of secondary school science and math teachers, secondary school administrators, and placement directors at colleges and universities to get another reading on the science and math supply and demand. The results of our surveys and the highlights from some previous studies are reported here.

The Demand

In 1980 and again in 1981, Howe and Gerlovich (1982) surveyed the 50 state science supervisors to assess supply and demand for secondary school science and math teachers. Using a scale of 1 (a surplus) to 5 (a critical shortage), they found a shortage of physics (4.15), math (3.71), and chemistry (3.96) teachers in 1980. Shortages in physics and math became more severe in 1981 (physics, 4.45; math, 4.28). Moreover, the shortages are nationwide. Only two state supervisors reported an adequate supply of math teachers; four reported an adequate supply of science teachers; six reported an adequate supply of chemistry teachers.

Akin's (1980) findings are consistent with the Howe/Gerlovich report. In a survey of teacher placement directors in 1981, Akin reported math and physics as the highest and second highest areas of teacher demand. Chemistry teacher demand was 7th and earth science 11th of the 38 areas ranked. The NEA report (1981) also ranked mathematics and natural and physical sciences as areas where the supply of teachers is least adequate.

The data from these sources are convincing but not compelling because, after all, science and math continue to be taught. In order to provide further insight into the problem, we conducted three surveys in December 1981. Our results are quite revealing.

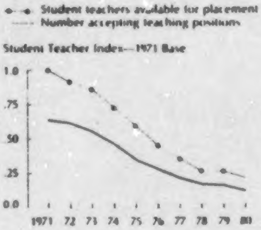
The Supply

We surveyed 450 teacher placement offices nationwide to obtain ten-year data on the number of teachers receiving certification in a science or math area and the number accepting teaching positions. Figures 1 and 2 show the number of persons available for placement and the number accepting teaching positions in math and science from 1971 to 1980. Clearly these graphs show the serious decline in the numbers of persons pursuing teaching degrees (79 percent decline in math and a 64 percent decline in science) and an equally serious decline in rate at which those prepared accept teaching jobs. The 1981 NEA report indicates a comparable decline in persons accepting teaching positions to persons prepared as teachers across all teaching fields between 1962 and 1979.

Who Is Teaching?

We also surveyed 1,000 secondary school administrators to find out who teaches science and math at their

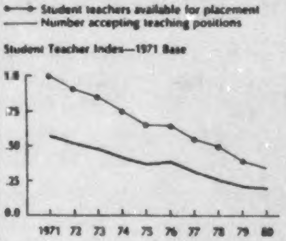
Figure 1. Student Teacher Supply Index: Math—Based on 1971 Supply.



Based on National Science Teachers Association survey of college and university placement officers. Conducted by J. A. Shymansky, The University of Iowa, 1982.

James A. Shymansky is Professor of Science Education, The University of Iowa, Iowa City; and Bill G. Aldridge is Executive Director of the National Science Teachers Association, Washington, D.C.

Figure 2. Student Teacher Supply Index: Science Based on 1971 Supply.



Based on National Science Teachers Association survey of college and university placement officers. Conducted by J. A. Shymansky, The University of Iowa, 1982.

schools, how many were retiring, how many were leaving for other jobs, and how many were hired recently. Administrators reported that 91 percent of their science and math teachers were teaching those classes exclusively in 1981–82—a drop from 93 percent in 1980–81. They also reported about a 1 percent rate of retirement in the science and math teaching staff and a 4 percent exodus to nonteaching jobs. Taken alone, these figures are not earthshaking. But data on replacements for the retirees and the job-jumpers are shocking. Nationwide, *half* of all newly-employed science and math teachers for the school year 1981–82 were unqualified to teach science or math. These teachers were reported hired on an "emergency basis." Figure 3 shows, by region, the percentages of emergency science and math teachers hired for the 1981–82 school year; the numbers are staggering but not surprising when viewed in terms of Figures 1 and 2. There simply aren't enough new teachers to replace those leaving or retiring.

What the Teachers Report

More than 450 teachers responded to a third questionnaire aimed at finding out about their preparation, their assignments, and their plans. From the survey we know that 60 percent of the science teachers report cuts in their budgets for supplies and equipment. These cuts are occurring at a time when school labs are already obsolete and teacher morale is low. We also learned that 79 percent of these teachers have not completed a ten-hour course or workshop in over ten years; 69 percent have never attended a computer workshop. Finally, 40 percent reported never attending an inservice course or workshop since they began teaching—an average of 16 years!

When asked about their plans for the next five years, a startling 24 percent indicated they plan to seek employment outside of education. Assuming only 4 percent actually leave the classroom for nonteaching jobs (as the administrator data suggests) and assuming the graphs showing the new entries into science and math teaching level out, the forecast for secondary school science and math is still gloomy. The mean age of the science and math teaching population is 41. As that mean moves up so will the number of retirees and the number of teaching vacancies. Demographic studies predict a leveling off of school-age populations and even a slight increase in the 80s. When these data are mixed together, it is clear that the number of emergency teachers will go up also—and that the quality of math and science instruction will go down.

Summary

Recent independent surveys all show a severe shortage of qualified secondary school science and math teachers. There has been a catastrophic decline in the number of persons preparing to teach science and math and, of those prepared, less than half take teaching positions. Secondary schools are forced to hire unqualified persons. In addition, as the mean age of the science/math teaching force rises and more experienced teachers seek employment in nonteaching jobs, the quality of instruction in our secondary school science and math classrooms will deteriorate further. We cannot afford to wait for the normal laws of supply and demand to correct the problems. A generation of school-aged children is far too precious a commodity. EL

References

National Education Association. *Teacher Supply and Demand in Public Schools, 1980–81.* W. S. Graybeal, Project Director. Washington, D.C.: June 1981.

Howe, T. G., and Gerlovich, J. A. "Critical Issues Dealing with the Supply and Demand of Science and Mathematics Teachers." Presented to the National Science Teachers Association Meeting, Chicago, April 3, 1982.

Akin, J. N. "Teacher Supply and Demand: A Recent Survey." Association for School, College, and University Staffing, Box 4411, Madison, Wis., 1980.

Figure 3. Percentage of Emergency Science and Math Teachers Hired in 1981–82.

Census Region	Percentage of Emergency Teachers Hired
Pacific States	84%
Mountain States	23%
West North Central States	43%
West South Central States	63%
East North Central States	46%
East South Central States	40%
North East States	9%
Atlantic States	43%
South Atlantic States	50%
Nationwide	50%

An NSTA Position Statement

Science-Technology-Society: Science Education for the 1980s

Preamble

Science and technology influence every aspect of our lives. They are central to our welfare as individuals and to the welfare of our society. All around us are examples of the importance of science and technology for production of food, shelter, clothing, medicines, transportation, and various sources of energy. There are an increasing number of science- and technology-related societal problems as well as increasing societal benefits. Science and technology are central to our personal and cultural welfare *and* to many societal problems. We must insure appropriate science education for all citizens.

However, the quantity and quality of science education for all people are not commensurate with the status of science and technology in society. When one would expect budgets, time spent on science-related subjects, and support for science education to be increasing, they are decreasing. At the same time these factors are declining, societal problems continue to require an understanding of science and technology. The burden of response rests heavily upon the shoulders of *all* persons associated with science endeavors—scientists, engineers, classroom teachers, other educators, and school administrators. Many of the problems we face today can be solved only by persons educated in the ideas and processes of science and technology. A scientific literacy is *basic* for living, working, and decision making in the 1980s and beyond.

There is a crisis in science education. The following science-technology-society problems demand immediate attention:

- understanding of science and technology are central to our personal and national welfare, yet public appreciation of science education has declined;
- increasing number of individual and societal problems which have an impact on the quality of life are related to science-generated technology;
- as the impact of science and technology on society has increased, the support for science education has decreased;
- compared to its recent past the United States has fallen behind in the production of scientific and technological goods and services, and
- women, minorities, and handicapped persons are under-represented in nearly all professional and technical roles in science and technology.

Declaration

The goal of science education during the 1980s is to develop scientifically literate individuals who understand how science, technology, and society influence one another and who are able to use this knowledge in their everyday decision-making. The scientifically literate person has a substantial knowledge base of facts, concepts, conceptual networks, and process skills which enable the individual to continue to learn and think logically. This individual both appreciates the value of science and technology in society and understands their limitations.

The attributes listed below help to describe a scientifically literate person. Each attribute should be thought of as describing a continuum along which the individual may progress. The progress of the individual's science education should be equated with progress along this continuum.

The scientifically and technologically literate person:

- uses science concepts, process skills, and values in making responsible everyday decisions;
- understands how society influences science and technology as well as how science and technology influence society;
- understands that society controls science and technology through the allocation of resources;
- recognizes the limitations as well as the usefulness of science and technology in advancing human welfare;
- knows the major concepts, hypotheses, and theories of science and is able to use them;
- appreciates science and technology for the intellectual stimulus they provide;
- understands that the generation of scientific knowledge depends upon the inquiry process and upon conceptual theories;
- distinguishes between scientific evidence and personal opinion;
- recognizes the origin of science and understands that scientific knowledge is tentative, and subject to change as evidence accumulates;
- understands the applications of technology and the decisions entailed in the use of technology;
- has sufficient knowledge and experience to appreciate the worthiness of research and technological development;
- has a richer and more exciting view of the world as the result of science education; and
- knows reliable sources of scientific and technological information and uses these sources in the process of decision making.

Recommendations for K-12 Grade Levels

Elementary School Science

Science should be an integral part of the elementary school program. It should be used to integrate, reinforce, and enhance the other basic curricular areas so as to make learning more meaningful for children.

A carefully planned and articulated elementary science curriculum should provide daily opportunities for the sequential development of basic physical and life science concepts, along with the development of science process and inquiry skills.

Elementary science should provide opportunities for nurturing children's natural curiosity. This helps them to develop confidence to question and seek answers based upon evidence and independent thinking. Children should be given an opportunity to explore and investigate their world using a hands-on approach, with instructional materials readily available.

The focus of the elementary science program should be on fostering in children an understanding of, an interest in, and an appreciation of the world in which they live.

Middle/Junior High School Science

The middle/junior high school science curriculum should be designed to accommodate the needs and learning styles of the early adolescent. Students should be provided with daily opportunities to explore science through reading, discussion, and direct learning experiences in the classroom, laboratory, and field.

Middle/junior high school science should contribute to the development of scientifically literate persons and not simply prepare them for the next science course. National studies have shown that often middle/junior high school science is designed to prepare students for high school biology with no emphasis on physical science. In addition, studies show that fewer than one half of the junior high students going on to high school take chemistry and physics. Therefore, it is imperative that an important thrust of middle/junior high school science be toward the physical and earth sciences.

Middle/junior high school students should continue to develop science process skills and content. Middle/junior high school science should emphasize the *application* of both skills and content to the students' personal life situations and enable students to begin examining societal issues that have a scientific and technological basis. Middle/junior high school students need to *apply* what they have learned soon after their instruction to insure the lasting value of the experience.

High School Science

The high school science curriculum should enable students to further develop their scientific and technological literacy. Courses incorporating well-designed laboratory and field work help to meet this need.

A balanced core of two years of science should be required of *all* students, consisting of one year of life science and one year of physical science—both taught in a science technology-society context. The courses should provide students with opportunities to develop skills in identifying science-based societal problems and in making decisions about their resolution.

Students interested in exploring or preparing for careers in science, engineering, or technical fields should have the opportunity to take additional discipline-based courses in advanced biology, chemistry, physics, and earth sciences. These courses should be planned and sequenced to take advantage of the students' increasing command of mathematics.

Time on science learning

- Lower elementary level (grades K-3): a minimum of 1½ hours/week of science should be required.
- Upper elementary level (grades 4-6): a minimum of 2½ hours/week of science should be required.
- Middle/junior high school level (grades 7-9): a minimum of 1 hour/day for at least 2 full years of science should be required of all students.
- Senior high school level (grades 10-12): a minimum of 1 hour per day for 2 full years of science should be required. The courses should represent a balance of physical and life sciences.

Emphasis on programs for all students

- In elementary, middle, junior high, and senior high school grades, science education programs should provide basic concepts for all students. Opportunities should be available for students with diverse interests and commitments, including students with exceptional interests and talents in science.

Emphasis on science education for the adult general population

- Schools should provide educational opportunities in science for all the adult population in their community.
- Colleges, universities, and national organizations should increase emphasis on science education for adults through public lectures and seminars.
- The important contributions of out-of-school education programs such as museums, TV, planetariums, and zoos, should be recognized and utilized by all those involved.

Emphasis on the professional development of science teachers through inservice opportunities

- Colleges, universities, and other agencies should develop teacher education and inservice education programs that are consistent with this policy statement.
- School districts should provide opportunities, encouragement, and recognition for teachers who maintain a high level of professional competence.

Emphasis of laboratory and field activities

- Elementary level laboratory and field activities should stress the development of basic inquiry skills.
- Middle/junior high school level laboratory and field activities should stress the application and extension of inquiry skills as a means of obtaining knowledge and resolving problems.
- High school level laboratory and field activities should emphasize not only the acquisition of knowledge, but also problem solving and decision making.

Science instruction matches students' cognitive, physical, social, and emotional development

- Schools should provide objectives, content, and instructional strategies that are appropriate to the student's stage of mental, moral, and physical development.
- Varying strategies and materials should be provided at all grades to accommodate students with various levels of learning skills and mental development.

Emphasis on science-related societal issues

- Elementary level: a minimum of 5 percent of science instruction should be directed toward science-related societal issues.
- Middle/junior high school level: a minimum of 15 percent of science instruction should be directed toward science-related societal issues.
- Senior high school level: a minimum of 20 percent of science instruction should be directed toward science-related societal issues.

This NSTA Position Statement was adopted unanimously by the Board of Directors in 1982. Additional copies of this position statement are available; write to the National Science Teachers Association, 1742 Connecticut Ave., N.W., Washington D.C. 20009.

The Committee to Develop the NSTA Position Statement
SCIENCE-TECHNOLOGY-SOCIETY:
SCIENCE EDUCATION FOR THE 1980s

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Mr. **Volkmer**. We appreciate your statements here today.

At this time, we will proceed to see if we have any questions for the witnesses. The gentleman from Florida, Mr. MacKay.

Mr. **MacKay**. I have a couple of questions. First, Mr. Jasinowski, on page 9 of your prepared statement, you indicated that the marketplace dynamics are the primary means to correct the imbalance felt in the labor markets for scientific and engineering personnel. This adjustment, however, will occur over the long run and could have negative repercussions in the interim period for the health of our economy.

I want you to know that I agree with what you are saying, but as I define the problem, the problem is that in solving its problem, the private sector will raise wages and will intensify the problem that Mr. Aldridge has identified within the school system. I see that as the way we should define our problem, which is how are we going to get qualified people to teach? That is what has happened already.

In fact, the school systems in this country for 100 years existed on a captive supply of black people and women. They didn't have to pay competitive salaries because these people had no other alternatives. Now, in the last 20 years that has disappeared. It is not computers. It is that the people who we had as captives are now free to take other jobs. And we are not adjusting by raising salaries.

What position does your association take on that?

Mr. **Jasinowski**. Congressman, I think you raise a good question, and I would make two points on it. The first is that education in this country is not a market phenomenon. We have made a commitment as a society to have public education as well as private and, as such, we have as a society decided that it has value beyond whatever the market supply and demand and prices are. I think that is probably the most important part of your question that I would respond to. Therefore, we have to decide in terms of overall budget priorities how much we are going to put into a system of basic education that is part private and part public.

The second point is much less important, but it can't be cast aside. It is that even in a situation where you have the salaries of individuals being bid up as they move into the private sector, you are going to have the salary levels of people in education eventually being bid up, too. It takes, unfortunately, longer than I think most people are prepared to wait. I would agree with that because of the international competition and technological change that we have to address in the near term.

So, on the time dimension, which I already indicated in my testimony, I think you are right again. So I don't think that I would disagree with your question in point at all. My point here is the larger one, which is let's not pretend that the Government is going to solve this problem, either leaving aside private sector cooperation or forgetting that the market is a pretty viable factor in terms of allocating resources.

Mr. **MacKay**. We had a strange phenomenon in Florida. In 1978, a group of the Association of Manufacturers came to Florida and demanded that we increase taxes to put more money in higher education in Florida. It so amazed everybody that we promptly did it.

Their point was we can't lure and retain high tech people in Florida because we don't have a first class educational system.

Mr. **Jasinowsky**. I think manufacturing industry as a whole is very supportive of trying to move forward in this area. It is hurting many industries, high tech and otherwise.

Mr. **MacKay**. Thank you. I appreciate that answer.

Mr. Aldridge, I didn't get your quote exactly, but you said that the problem is with the National Science Board which is isolated—I thought you said from the broader concerns of the scientific community, and thus has channeled the funds into areas that are entirely different from that contemplated by the organic legislation that organized it.

Mr. **Aldridge**. Yes. The foundation was originally set up to do both science education and to support scientific research, and the science education was to be at all levels. The National Science Board is constituted almost entirely of persons who have the research interests or they are administrators at major universities. No one on the National Science Board is representative of the science education community, as I know it.

As a consequence of that constituency, the Board's policies invariably are not supportive of science education. It has been this committee— in every case this committee—which has put programs at the foundation, and they have been very good programs and they have been successful.

Mr. **MacKay**. Since we are doing oversight on their budget, would it fall from your line of reasoning that they are the people we should have in here if we want to start dealing in part with this problem by saying we expect you to do more in that area than in the field of research?

Mr. **Aldridge**. Yes. You see, the fact that you had 17 bills in the last session on this subject and 11 so far in this session, in my judgment, that is evidence of the negligence of the National Science Board.

Mr. **MacKay**. I read a report that they say is a preliminary report that they think we have got a problem. It kind of struck me as strange that that came out 3 or 4 or 5 years after most of the States had done the same study if they are they are the national focal point for concern in this area. That is, I think, the sum total of what they have done thus far is a preliminary report that says next year we will tell you what the problem is. Is that correct?

The **Chairman**. I am not that familiar with the report. We will have the National Science Foundation up next Wednesday and Friday. I think it would be appropriate to query them about that report.

Mr. **MacKay**. I can appreciate your frustration, Mr. Aldridge.

I guess I would go back to the question I was trying to ask Mr. Dinancescu which was, do you define this thing narrowly in order to reflect the fact that we are not going to put enough money into it to resolve a big problem, or do you define it broadly and say this is only the first step?

It seems to me you have defined it narrowly for the first time today. Our problem is we don't have enough qualified teachers at the secondary level, and we are having some real quality problems at the postsecondary in teaching. Would you say that is a narrow definition?

Mr. ALDRIDGE. Yes. I believe firmly that you have sufficient money in this bill to do something important about the problem. You can't do this by formulas and entitlements and the kind of thing I have heard over the last few days at hearings. You have to take into account the merit and need, both. It doesn't seem to me that that is being taken into account when you distribute by various formulas.

NSF never operated that way. They are an agency which has function on the basis of merit. It is high quality. You can trust the decisions which have been made. As a result, there have been some very important and useful things done in science education. They haven't necessarily wanted to do it but, thanks to the Congress, they have been forced to.

Mr. MACKAY. It would seem to me the other thing you said that was important was if you could have a better feel that whatever was done was done freer from the local political pressures, if it was done with the NSF, you would have a better guarantee that it was qualify.

I thank you.

Mr. VOLKMER. I have a couple of questions I would like to ask. I would first like to make sure we all understand from where we are coming, and maybe we could agree or disagree. The way I see it we not only have a shortfall in teaching capacity at the lower levels and the secondary levels, but we also have a shortfall in the university and college level. Do we agree on that? Do we agree on that, Mr. Aldridge?

Mr. ALDRIDGE. I believe the evidence is clear in the case of engineering. I don't know that it is in other areas.

Mr. VOLKMER. Such as in physics or in chemistry or those types? You are not sure that they are?

Mr. ALDRIDGE. I don't believe that the evidence would support that.

Mr. GEILS. That is quite right, sir.

Mr. VOLKMER. Definitely in engineering?

Mr. GEILS. Definitely in engineering, broad gauge and across the board. But not so in all areas of mathematics, physics, chemistry, biology, and other areas.

Mr. VOLKMER. In other words, you say like in general math or those types in higher education, we don't have to worry about the professor who is going to teach calculus or things like that?

Mr. GEILS. It is spotty, but, in general, that is correct.

Mr. VOLKMER. All right.

Mr. MACKAY. Would the gentleman yield?

Mr. VOLKMER. Yes.

Mr. MACKAY. In the National Association of Manufacturers' testimony, there is a statement that the proportion of recent doctorates, people holding degrees for 7 years or fewer, declined from 39 percent in 1968 to 28 percent in 1974 and 21 percent in 1980. It would seem to me that indicates that there is a problem there, it just hasn't hit us yet, if that is reflective of a broader problem than just engineering. It says engineering and science.

Mr. **Jasinowski.** I am of the impression, Mr. Chairman, that it is somewhat broader than engineering. It is clear that the engineering numbers are the most dramatic, and these gentlemen are perhaps more expert than I in terms of all of the data on this. But my impression is and the impression of my members is that we have a broader problem in high education as well.

Mr. **Volkmer.** Mr. Geils, would you include the computer sciences within the engineering?

Mr. **Geils.** I would indeed.

Mr. **Volkmer.** Then we recognize there is a shortfall there also.

Mr. **Geils.** A very, very dramatic shortfall.

Mr. **Volkmer.** My problem is that I feel we have these shortfalls, too. Mr. Aldridge, looking at your page 6, your requests, I serious question whether there are sufficient funds in the undergraduate science, math and engineering education part, as far as we are going to be able to provide the teachers to teach the teachers.

Mr. **Aldridge.** In the part which I am proposing, there currently is nothing. So I am proposing going from zero to something. We are really talking about the undergraduate institutions themselves. That item in our testimony has nothing to do with teachers.

Mr. **Volkmer.** Go ahead. I think we have a misunderstanding here, but go ahead.

Mr. **Aldridge.** We were taking into account the fact that one needs—we were not asking for support for our own clientele in that particular segment of our recommendation. We were recognizing the needs of those institutions. If we are going to have teachers who are going through those subject matter courses, that is, people who would become teachers, for them to be adequately prepared, there has to be support at the undergraduate level. So it was a secondary type of support that we thought was needed for preparation purposes.

The second part on page 6 was our recommendation regard to the precollege level that would look specifically at what would be for teachers or science education programs at that level.

Mr. **Volkmer.** You don't disagree that we need an effort as far as providing fellowships, et cetera, for faculty at universities and colleges in order to retain those people and to bring on new people?

Mr. **Aldridge.** No. We don't disagree. The point is that you are not going from zero as you are in the case of precollege. You have an NSF program in place now with already $15 million, and they are going to raise it $4 million next year already for fellowships. You have a billion dollars over there in one agency, much of which goes in that direction. You have a Department of Energy, you have a Defense Department, you have the National Institutes of Health. All of these are feeding the graduate students.

There is absolutely nothing for precollege science and mathematics education. You can't look at this in isolation of all of those other programs.

Mr. **Volkmer.** I understand where you are coming from. Thank you very much.

The other question I have—and it goes a little bit on what the gentleman from Florida has alluded to in his first questions—just to get right to the point, what is going to curtail the flow of teachers to industry, or faculty to industry, even with this? We are still going to have a need, are we not, in industry, and that need is going to continue to grow?

Mr. JASINOWSKI. I think that, first of all, this bill is probably not going to curtail that movement altogether. I think that other measures might have enough effect to curtail it. It may impede it, but it is not going to curtail it.

I think that the assumption that higher salaries in industry or people moving into industry in science and technology is a bad thing is a mistake. I know most of our members don't like to pay the higher salaries, but the fact of the matter is, as the economy changes and people do things which have higher productivity and value and competitiveness, they end up getting paid more. Therefore, the fact that computer-trained people are getting paid more now than they did 10 years ago is a good thing, relative to, let's say, people who are in the preparation of metals of one kind or another that are of less value. So people moving like that is not necessarily a mistake or wrong. I think that we ought not to think so.

The question, I think, is to what extent does that begin impeding basic education and the rest of our educational system, and how does that work relative to our overall priority on education as a society? That is something that economists can't answer. It is not something that a person analyzing markets can analyze. It is something that you, as Congressmen, can analyze better. I think it is more than a political question, it is a question of how much do your constituents want to pay for public education to raise our overall levels there.

I think that is an area which I personally would think we ought to put more money into. But it is not something that market analysis and economists can give you any definitive answer on. So I am saying it is in part an economic question and in part a political question.

Mr. VOLKMER. Mr. Geils.

Mr. GEILS. Yes, sir. I have some data from our most recent survey which shows that in the engineering arena again only, those who left industry for teaching numbered 251 in one particular year. The reverse flow, the ones who left teaching to join industry numbered 266. We see it as an almost standoff situation, and there is no way anyone can legislate against that kind of mobility.

Mr. MACKAY. Would the gentleman yield?

Mr. VOLKMER. I yield to the gentleman from Florida.

Mr. MACKAY. Let me tell you my statistics from studies that we were doing in the Southern Regional Education Board last year. They indicated that 15 percent of the midcareer teaching profession quit last year. They went somewhere, and that is more than 261 people.

Mr. GEILS. I am just talking about engineering. Your sample is broader.

Mr. ALDRIDGE. May I respond to that?

I have some specific data on the 1982-83 school year. I can tell you that around 6,500 secondary school science and math teachers left teaching to go into employment in the private sector. This was at the end of May of last year. And about 2,500 teachers retired. So it is a ratio of more than two to one going into the private sector.

This is at a time when the secondary school enrollments in science increased in the current school year.

Mr. **Volkmer**. In other words, it appears to me that we still may have this problem with us in certain fields, even 3 or 4 years down the line, depending on demand and how well this program works and depending on demand in private industry.

Let me ask you one other question, if I may. How do you view the impact of additional defense spending and programs and things like that in this area? Doesn't that, too, create a demand for these similar type of people?

Mr. **Geils**. Yes, indeed. In fact, when I talked to the DOD, their need for engineers is about as heavy as industry's need for engineers. They are as concerned as we are over this issue. You have got lots of witnesses in the Pentagon who will attest to that.

The **Chairman**. If the gentleman will yield, I think that last year when we held these hearings—I know you testified—General Marsh testified, who is head of the Air Force Systems Command. He at that time said they were over 10 percent short of qualified engineers just to help the Air Force manage contracts in his one department. That doesn't include the Navy and the Army and the Marine Corps.

Mr. **Geils**. And nothing has happened in the past year to make that any better.

The **Chairman**. That was last year, but I am sure that is recently the same figure. It might have even increased some.

Mr. **Volkmer**. I have taken my time. I will now recognize the Chairman.

The **Chairman**. I don't really have any questions. I think Mr. Aldridge raised a question I would like to comment about. That was about the matching funds in title II of the bill.

The National Science Foundation has now about $39 million that does not require any matching funds that can be used to assist areas that appear to be deprived of funding under this. There are no strings as to how that must be administered.

Also, there is nothing in the bill that prevents, through groups or associations, and so forth, making contributions to the NSF, and then NSF distributing them on a need basis nationally. That doesn't necessarily have to be a formula—Michigan gets so much, Florida gets so much and Missouri gets so much, and then you have to match it. It can be worked in many ways.

We were attempting to have a maximum amount of flexibility in this. That is why we didn't try to write in a lot of rigid rules of how it should be administered. We felt like it would be better to do it without having the inflexibility of the law telling them how it had to be administered. So we are attempting to accommodate that concern.

Mr. **Aldridge**. Mr. Chairman, are you referring to the current year's budget or a proposal in one of these titles? I have seen the guidelines in the current year's program, and there is a 50-50 matching requirement for the $15 million at NSF.

The **Chairman**. That is their guideline. There is nothing in the law that requires that.

Mr. **Aldridge**. I see.

The **Chairman**. We have talked to them about this type of approach even last year, and they may have gotten that idea that we intended that at that time. But that is not a law that requires that.

I am informed by staff that that is being reviewed by the Appropriations Committee and that may be modified before it is finalized.

Mr. **Aldridge**. We certainly hope that is the case. We have seen the guidelines and, again, that is only $15 million and I believe only $14 million of that is available for institute programs. The balance is for graduate fellowships, I believe.

The **Chairman**. Jack, you mentioned that in lieu of matching funds, equipment and other things be made—in lieu of actual dollars. Of course, we haven't really prohibited or intended to prohibit that type of thing, nor have we encouraged it. I don't want it to all be in-kind contributions, because we are going to have to have some funds to help pay for the fellowships. But on the other hand, one of the things that this is designed for also is for instrumentation and equipment.

Mr. **Geils**. We just didn't want it to be excluded.

The **Chairman**. Right. And maintenance contracts.

Mr. **Geils**. Yes, exactly. That kind of stuff, the more sophisticated the oscilloscopes and the signal generators and other things get, the more you need hard service maintenance for that stuff or it is useless.

The **Chairman**. And it costs money.

Mr. **Geils**. Yes. It costs real money.

The **Chairman**. I don't think the way the language is written—I will check it again—I don't think we intended to preclude that from happening. As I say, we wrote it very vague on purpose so that it would allow a maximum amount of flexibility, and they would not have to come up to Congress every time they wanted to change a word or some unique situation that might develop.

Mr. Volkmer, if there are no further questions, I want to thank all three of the witnesses for being here. We have had a full day, since 9:30 this morning. I want to thank you and all of the other witnesses that have been here. I think this has been very helpful. I think it is indicative of the full committee participation during the day. I thought I might be the only one here, but I am very pleased that my colleagues indicated their interest by their presence. I hope that we can move forward on this bill just as rapidly as possible. We thank all of you for your contributions.

The committee will stand adjourned until 1 p.m. Tuesday.

[Whereupon, at 5:06 p.m., the committee was adjourned.]

[The following was received for the record:]

APPPENDIX

National Public Television

National Association of Public Television Stations

Suite 7200
955 L'Enfant Plaza, SW
Washington, D.C. 20024
(202) 484-9030

Bruce L. Christensen
President

February 15, 1983

Representative Don Fuqua
Chairman
Committee on Science and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

We share your concern for increased attention to America's science policies and personnel needs as stated in H.R.582. We have already expressed our views on HR30, the companion legislation to H.R.582, stressing that America's public television system has the capacity to aid in improving science and mathematics teaching in the elementary and secondary schools.

Now we offer these brief comments regarding H.R.582.

It is our conviction that, in order to promote and encourage technical, engineering and scientific personnel development in the private sector and in higher education, it will be necessary to communicate these needs and goals widely. Not only do those in these target areas need to know them, but the public also must know them--and help to support them. Otherwise, experience has shown that this sort of effort will again cease just as soon as federal fund stop.

Public television programs have demonstrated their capacity to inform the public--and educators and business people--in such areas. Last year over 14 million households watched PBS science programs. But we believe that special additional support will be necessary to help these new specific targets. The National Science Foundation's Public Understanding of Science achieved much before it was terminated last year. Either this activity or one similar is needed again. We cite two examples:

--NOVA, the PBS weekly science magazine, is a major national information source about science. NOVA is PBS's most-viewed program by teenagers, and ranks very high among all young adults. NOVA's program on Westinghouse science winners last fall was seen in over 6 million American homes.

That program brought Congress's and NSF's concerns to the public and showed us all some extraordinary future American leaders in science. NOVA could do more, but no longer receives any support from NSF's PUOS funds, and depends on increasingly difficult funds from public television stations and from business and foundations.

--3-2-1 Contact, the Children's Television Workshop science series for 8-12 year olds, reaches over 4-1/2 million homes weekly, along with tens of thousands of youngsters in classrooms. These programs not only interest young people in science, but also emphasize the growing opportunities for women and minorities in these areas. And not only are young people viewing, but so are their parents and teachers--on whom the burden of support falls for any lasting change in science in America. Yet 3-2-1 Contact no longer receives PUOS funds either and has now had to curtail future production of programs as a result.

We believe this sort of program can provide vital assistance to this campaign initiated by the Congress. We ask that funds be earmarked for this public outreach effort in the legislation which you approve.

Sincerely,

Bruce L Christensen

Bruce L. Christensen

NEWSDAY FEBRUARY 4, 1983

AS I SEE IT

TV Can Teach Science and Math

By William Finegold

Our nation's schools are facing a crisis in science and mathematics on the secondary school level caused by the shortage of science and math teachers. This shortage will have a serious impact on our country's future capability in the area of scientific and industrial research and development as well as our national defense.

One major reason given for this shortage of teachers is that college graduates who excel in science and math are recruited for positions in industry that are more remunerative and possibly more challenging.

One practical solution that has not received sufficient consideration is the expanded use of television to teach science and mathematics. The top teachers at the secondary school and college levels could be recruited to develop and teach these courses. They can be broadcast over public TV stations, closed circuit TV or cable, or they can be put on videotape to be used at a school's convenience.

Science and math would seem to be the ideal subjects for the use of electronic instruction. The TV screen and computer offer the special advantages of color and animation as well as dramatic and graphic presentation. We have seen how the younger generation is attracted by television, the computer and the excitement of electronic games. This interest can be built upon and broadened in science and math instruction.

Scientific experiments can be shown on the screen in full color, magnified many times over with the use of the electron microscope. Slow motion and stop action photography will enable the students to study biological, chemical and physical processes in minute detail.

In a very practical way, these television presentations will serve as demonstration lessons for current as well as future science and math teachers. The ideal way to improve the quality of instruction is for superior teachers to demonstrate the finer procedures in the art of teaching.

On the college level, these televised science and mathematics lessons will provide training in methodology as well as content for the students preparing to enter the field of teaching. These college students can, at the same time, be utilized as teachers-in-training or interns on the secondary school level. They will be able to follow up the television presentations with the high school students on a group or individual basis in the classroom or laboratory. It would be feasible to pay them some stipend as part of this work-study program.

The dual value of science education and teacher training through television is cited by Robert Diamond of the University of Miami, who states: "The use of television in science instruction has allowed the schools to increase the amount of individual attention for our exceptional children, and it has permitted an excellent program of teacher education with minimal expense to the district . . . We are convinced that television, properly used, will bring the most talented instructors and the highest quality of instruction."

TV programs with science content, such as "Cosmos," "Connection," "Nova," "The Ascent of Man" and "The Body in Question," have attracted a large audience. Although they have been intended for the general public, study outlines are available for some of these courses, and some colleges do grant credit for students who watch such courses, do additional readings, and take an examination based on the TV course.

> *College graduates who excel in science and math are recruited for positions in industry.*

Other general television courses have been adapted for college students, and colleges throughout the country are granting credit for such courses. Despite the fact that these programs were not designed for instructional television, they do indicate its potential as a teaching tool. Last year 56,000 students in more than 500 colleges in 47 states took television courses offering college credit, some in science and mathematics.

The shortage of science and math teachers may provide the opportunity for a breakthrough in the use of instructional TV. If the best scholars, educators and media specialists pool their talents, they will not only fill the science and math teaching gap, but also improve the quality of instruction. They may even help TV fulfill its potential for becoming the exciting tool for learning that some educators foresaw in its infancy.

William Finegold is a retired school principal who works as an education consultant. He lives in Jamaica.

STATEMENT OF THE

NATIONAL EDUCATION ASSOCIATION

Mr. Chairman:

The National Education Association (NEA), which represents 1.7 million teachers, higher education faculty, and educational support personnel in all 50 states, welcomes this opportunity to present its views of the Emergency Mathematics and Science Education Assistance Act, H.R. 1310, and to raise our concerns about the need to improve math and science education for our nation's young.

We commend the Chairman for holding these hearings on providing emergency assistance from the federal level to local schools and higher education institutions to develop an immediate response to science and math needs. The problems and deficiencies in the areas of math and science are growing to crisis proportion, and we owe it to our young people to respond now.

Yet, at the same time that we commend your deliberations on this important legislation, we must reiterate our position of viewing it only as a partial response to the crisis facing our educational system. We support the concepts on which H.R. 1310 is built, but we believe it is imperative that it be seen as part of a larger and far more comprehensive program—that encompassed by the American Defense Education Act introduced in this session of the Congress.

During hearings on the American Defense Education Act last fall, Members of the Education and Labor Committee heard from illustrious and concerned witnesses, including your own colleagues from the U.S. Senate, representatives from industry, education, and from prestigious institutions such as the National Science Foundation. All expressed dire warnings about the state of science and math training as it impacts on our nation's ability to maintain her place in the increasingly competitive international economy, to stay as the leader in the development of advanced technology, or to have a national defense that is truly secure—both from outside threats and internal decline. All these witnesses called on you as legislators to carry out your mandate of public information and education to confront and deal legislatively with the issues raised in the ADEA.

Many of the points made during the two days of ADEA hearings are relevant to this Committee's discussion in its effort to deal with the problem. Several of the points the NEA made in that testimony restate our support for the need for a comprehensive and meaningful response to a pressing national need for which this bill is a first step.

Before turning to the highlights of the ADEA testimony, it is important to focus on a vital element of NEA's efforts with the ADEA; the NEA criteria developed in assessing not only the ADEA, but all math and science education proposals.

These criteria, attached in the appendix of this statement, provide an important evaluative framework for the NEA and its members to approach any math and science education initiative before Congress. Several of these criteria stand out during this discussion of H.R. 1310:

* Role for the Department of Education: NEA criteria for math and science initiatives call for an administrative role for the Department of Education, especially for any legislation which directly affects classroom teaching of the young. This criterion becomes directly relevant in terms of H.R. 1310

in as much as Part A of Title II of the bill, introduced earlier in this session of Congresses H.R. 582, calls for a direct role for the National Science Foundation in the administration of the Engineering and Science Personnel Fund. The NEA believes that such administration should be carried out in cooperation with the Department of Education.

* No differential in pay for teachers: The NEA strongly opposes any proposal advocating a differential in pay for teachers in math and science. This band-aid approach to the problem of attracting and retaining teachers in the areas of math and science is very shortsighted. Pay differentials--sometimes referred to as merit pay--make a strong statement to all teachers: some subject areas are more important than others. After all, without reading and writing skills, no child can learn science or math. This means that education at the elementary school level must be taken into account in any initiative proposing to improve math and science training. Without a basic framework on which to build from the earliest years, students will not be able to achieve their potential in any subject area.

It is clear, in addition, that recruiting well-prepared teachers of English or other languages, art or music is as vital as hiring good math and science teachers. The pursuit of all-around quality must stay as a guiding education policy. "The Shortage of Math and Science Teachers: The Problem, Some Solutions", an article appearing in the NEA Collective Bargaining Quarterly is attached to the appendix of this statement. This highlight is relevant:

> "Added-pay schemes fail to take into account two fundamental considerations: why people enter teaching and why they remain in it. Virtually every available study shows that people enter the field primarily because they want to work with young people. These same studies reveal that many leave because of inadequate time to teach and because of other factors that are not directly related to salary. Obviously, salaries for all teachers must be raised, but there are other ways of making teaching more attractive than simply paying more to teachers who are--perhaps only temporarily--in short supply. Class size must be made manageable, non-professional duties must be reduced, and teachers must be given time to pursue courses and other professional development activities to help them improve their teaching and their sense of self-worth. These changes cost money, but money that will aid teachers--and students--not only a select few."

ADEA: A Comprehensive Response to a National Crisis

There is not much difference of opinion nationally when it comes to defining the central ingredients that have helped build America's greatness: unprecedented economic growth is always listed at the top. Sustaining that economic growth provides a crucial foundation for maintaining this greatness, and underlying that growth is the need for an educated, skilled labor force.

Increasing education is the major source of economic growth in the U.S. since 1930, according to the Brookings Institute. They argue that improved education accounted for two-thirds of the increased growth in the American economy from 1948 to 1973, a 25-year period of remarkable economic growth that was coupled with an extraordinary increase in public investment in education. Conversely, a 1982 report prepared by the Education Commission of the States, "Information Society: Will Our Graduates Be Ready?", predicts that skilled labor shortages will be the major obstacle to future growth in the U.S. Indeed, we will face a long-term crisis if we do not begin to seriously concentrate on preventing these shortages.

Math and Science Education Needs

Hundreds of media stories in the last year have centered on the current post-Sputnik math and science crisis in the U.S. At a time when projected labor force needs show strong growth in jobs areas such as engineering, computer work or electronics, all of which require math and science skills, U.S. students are taking fewer courses in these subject areas than ever before. (See Appendix A)

Statistics comparing years of training in math and science between U.S. students and their counterparts in other competing countries such as the U.S.S.R., West Germany or Japan—reveal a widening gap, with our students coming out at the bottom end of the scale.

Feeding into this problem is the shocking shortage of science and math teachers across the country. Many teachers neither specifically trained for nor certified in math and science, are pinch-hitting in the classroom in these subject areas; this, even as math and science are being hailed as the 'nation's top educational priorities'. This situation hurts teachers and students alike, and must be addressed to adequately respond to technological, economic or national security challenges currently facing us.

Changing Demographics

The face of our nation is being changed daily by the most striking demographic shifts in our entire history. Apart from continual growth in the population, a rise in the number of elderly, and shifts in population from the Frostbelt to the South and West, a number of other dramatic changes are occurring.

The phenomenal increase in the number of women working outside the home is expected to continue. This will mean not only that services such as dependent care will need to be improved, but also that educational opportunities will have to be expanded, especially with regard to retraining needs for workplace skills. In addition, new approaches to the workday, such as flex-time and work-at-home arrangements will by necessity become more commonplace.

In addition, the increase of our minority populations will continue, with the largest rise occurring among Hispanics. This will add tremendously to the need for bilingual education programs. And, since 30-40 percent of the labor force growth over the next decade is expected to occur among Hispanics, it will be imperative to raise the proportion of high school graduates among this group above the current 55 percent level. (See Appendix B)

The Technology Revolution: The Rolling Wave into The Future

Some would describe the technological explosion as an earthquake in our midst--one that is causing a huge shake-up in the very foundations on which our economy, society and culture are based. Alvin Toffler, in his book The Third Wave, describes the profound changes that the technological revolution has wrought as the "single most explosive fact of our lifetime." It is one that is affecting our work lives, family lives, governmental policies, and cultural expression. And it is one that, by necessity, is impacting on our education policies as well. This revolution—during which many of us go about our daily business at times even unaware that we are in the midst of such upheaval—has been catapulting the workplace into a laboratory of innovation and change; replacing our former goods-producing economy into one based increasingly on service and information; and restructuring almost entirely our means of communications. This revolution in technology indeed promises no end in the foreseeable future.

The explosion in technology has not been confined to the U.S. Countries such as Japan are in many ways surpassing our own technological capabilities. This fact alone has been important in the development of the heightened competition between our economy and those of many other countries. Without an adequately educated and skilled workforce, the U.S. will never be able to regain the advantage in this increasingly competitive international environment. (See Appendix C)

Military and Defense Needs

Shifting our focus slightly from the international economic arena brings us to the area of national security. As the revolution in technology has impacted on nearly every facet of our lives, so has it also—even more dramatically—on our defense needs and structure. Weapons and weapons systems are increasingly complex and sophisticated, and they require increasingly well trained and highly skilled people to operate them. This increasing sophistication of military technology and management needs calls for great strides to be made in the basic and advanced skill levels of armed forces personnel with regard to math, science, technology and communications.

Yet, the ability to operate and maintain weapons and weapons systems cannot be our only goal with regard to military training. The constant threat of nuclear annihilation makes it imperative that our military leaders think of themselves as men of peace, not war. Just as our nation cannot have a truly secure national defense unless its citizens are healthy, well-educated and employed, neither can our military leaders play a vital role in keeping world peace if they think of themselves only as soldiers. A broad view of education must remain a goal for all our nation's citizens. It is indeed one of the best hopes for the future, not only for our country, but for the entire human race. (See Appendix D)

Even since the ADEA hearings last year, a great deal more has been highlighted in the media about the ongoing and increasing need for a stepped up national commitment to math and science training in the U.S. Some of the more dramatic figures recently issued are:

* Current U.S. employment stands at roughly 12%; yet the only jobs which are going begging are in highly skilled areas requiring math and science backgrounds. For example, the Washington Post classified ads for Sunday, January 23, 1983, listed more than 100 separate employers seeking candidates for high level computer jobs; more than 70 employers seeking engineers, and over 70 searching for registered nurses. It is clear that having enough people trained to fill these jobs will not solve our nation's unemployment crisis, but it does provide us with important guidelines for our training and education needs.

* This current trend promises to hold for the future too. A study by the Electronic Industries Association published in May, 1982 projects a significant growth in the demand for technological personnel, both in professional and para-professional categories. Between 1981-85, most job category needs are expected to increase over 20 percent per year, with the greatest growth in the general fields of electronic and software engineering.

* This heightened demand for engineers was underscored in a November, 1982 Chicago Tribune article, "The New Worker" which highlighted math and science needs. The article quoted a forecast by Thomas Martin, Jr., president of the Illinois Institute of Technology, which projects that by 1990, 300,000 engineering jobs in the U.S. will go unfilled due to the lack of expertise in math and science skills among U.S. students. Yet, the Electronic Industries Association in the above-cited study, points out that the percent of foreign, non-immigrant nationals receiving graduate degrees in engineering has continued to rise in the last two decades. The study states, "The number of foreign non-immigrant nationals receiving graduate degrees in engineering as a percent of the total number of engineering degrees granted by U.S. universities continues to increase. At the master's level, this ratio has increased to 1 in 4, while at the Ph.D. level, over one third of all engineering recipients are foreign nationals."

* The media has also shed light on the widening gap between the haves and the have-nots in school districts throughout the country. For example, school districts in wealthy areas, and students in private schools, are being exposed to computer and information processing machinery in much greater numbers than are their poorer counterparts.

This gap will become increasingly important, as, in the words of a vice president of the hi-tech giant TRW put it in a November, 1982 "Time" magazine article, "Peering into the Poverty Gap": "It's not just a matter of number crunching. It's a new way of thinking. The kids who don't get indoctrinated to computers by seventh grade are not going to develop the same proficiency (as others)." A computer education specialist with the National Science Foundation added in the same article: "Power is not distributed evenly now, and computers will broaden that gap."

The Emergency Mathematics and Science Education Act (H.R. 1310): A Good Beginning

The NEA strongly endorses H.R. 1310, as reported from the Education and Labor Committee, largely because it recognizes and addresses the pressing concerns raised within the American Defense Education Act, and is a fitting prelude to the passage of the ADEA—a much more comprehensive and far-reaching initiative. One weakness of H.R. 1310 is the amount of money allocated to meet the problem, and a second weakness is its failure to direct at least 95 percent of its funds to the local education agency level. We believe that direct funding to the local level will be the key to any successful legislation. It is here that the nation's education policy is administered and operated, and it is here that the need exists.

The Emergency Mathematics and Science Education Act (H.R. 1310) wisely provides for important evaluative and planning work to be carried out under its auspices. This aspect of the bill, especially with regard to the call for an evaluation of local resources for, and the development of innovative responses to math and science education needs, is a responsible use of the bill's limited funding and time frame. Time spent in evaluating and planning under the Emergency Mathematics and Science Education Act would effectively set the stage for passage, and enhance the implementation, of the American Defense Education Act.

We applaud the call within the bill for various sectors of the community—teachers and local school boards, business and labor leaders, and others interested in education—to work together in developing and implementing tailor-made programs. We stress here that teacher involvement is key. Without that involvement, the problems to be addressed might be theoretical and not practical. This could lead to solutions that would be misguided and ineffective unless the professional classroom voice is heard.

We believe that the section of the Act which appropriates funds for summer institutes, teacher centers and workshops for teachers—again with teacher involvement in the planning—will serve to increase their skills in using the latest equipment and resources to improve classroom instruction.

Moreover, the bill's provisions to strengthen education research and development are vital. Its call on the National Institute of Education, in conjunction with other appropriate federal agencies to support improvements in research in the physical sciences and teaching students, as well as in the use of instructional technologies and in the analysis of local and institutional policies "enhancing or inhibiting the recruitment, retention, and upgrading of mathematics and science faculties" would be a very wise use of federal funds.

Developing Science and Engineering Personnel

Title II, Part A of H.R. 1310, recently introduced as H.R. 582, raises important policy issues that will help to strengthen the overall impact of H.R. 1310, especially with regard to its provisions to identify, and continually assess workforce and human resource needs in the area of engineering and the sciences.

NEA concern with this portion of the Emergency Mathematics and Science Education Act lies predominantly with the role called for in the bill for the Office of Science and Technology Policy with the Executive Office of the President, and the National Science Foundation. The Office of Science and Technology Policy in the executive purview is responsible for development research and development policies for science, engineering, and technical personnel, while the National Science Foundation is put in charge of the Engineering and Science Personnel Fund to promote and develop technical, engineering, and scientific personnel resources.

The NEA believes that there is a role for the National Science Foundation within H.R. 1310. The NSF's achievements in fostering scientific growth and knowledge in the U.S. have been tremendous, but their role in science education per se has been much more pronounced in higher education circles than at the elementary and secondary levels. As such, we would reaffirm our call for a role for the Department of Education within the administration of the Engineering and Science Personnel Fund, especially with regard to any training of classroom teachers.

Conclusion

The NEA reaffirms its support for H.R. 1310 as a measure to provide the basis for the full and effective implementation of a much more comprehensive measure--the American Defense Education Act. With the groundwork laid by the Emergency Mathematics and Science Education Act for assessing needs and planning programs, ADEA funds can be targetted more immediately into needed areas.

We at the NEA thank you for your leadership role in bringing and keeping this vital education issue raised by this measure before the American people. We stand ready and willing to work with you to see that the best possible legislation is passed and enacted to improve math and science education in the United States. Our children deserve no less.

Appendix A

Math and Science Concerns

Currently, American youth in the 15,000 school districts across the country are not adequately prepared to take on the economic, technological or national security challenges facing the nation. For example:

- Fewer students are taking fewer courses and spending fewer hours studying math and science.

  —A 1980 survey prepared by the Center for Education Statistics of a representative sampling of high school senior graduates in the U.S. revealed that only one-third of those sampled had taken three years of math or more. While more than half of academic students had taken at least three years of math, only a fifth of the general and vocational students graduate with three years of math.

  —This same Center for Education Statistics survey also revealed that only 41 percent of academic students completed three or more years of science courses, with 13 percent of general students and 9 percent of vocational students taking that same number of years in science.

- The growing shortage of math and science teachers has become critical.

  —There are only 10,000 physics teachers in the nation's 15,000 school districts.

  —An Iowa State University study prepared in the fall of 1982 showed that a survey of education departments in 45 states revealed that 40 state offices reported either shortages, some critical, or mathematics teachers, and 39 reported shortages, again, some critical, of chemistry teachers.

- The federal government's commitment to research and development, and to science education in general began to decline in the 1960's with support for graduate fellowships in science and math, and for teacher training institutes and curriculum development dropping dramatically in the last two decades.

- A study produced by the Electronic Industries Association showed that although the National Science Foundation has been receiving steadily increasing funding over the years' funding for science education has dropped significantly from 47% of the total NSF budget in 1959 to 7% in 1981, 2% in 1982, and a budgeted 1.4% in 1983.

Appendix B

Demographic Shifts

Some of the following demographic shifts will have a dramatic impact on our society for years to come:

- The Census Bureau predicts that our population will increase by 18 percent by the year 2000—jumping from the 1980 figure of 226.5 million to 267 million.

- The median age of Americans will climb from 29 in 1977 to 33 by 1990. By 2000, there will be more than 36 million Americans over the age of 65, and they will constitute more than 13 percent of the population.

- A "baby boomlet" is expected to occur through 1985, as the number of women between the ages of 18 and 34 moves from 32.1 million in 1979 to 33.9 million in 1985.

- Minorities will account for more than half the population increase in the next two decades because of high birth rates and immigration. By 1985, the non-white population will equal more than 22 percent of the total U.S. population, while white, non-Hispanic Americans will drop from 80 to 75 percent of the population.

- There will be a steady shift in population from the Frostbelt to the South and West, and in the Southwest, population growth will occur most among Hispanics.

- The number of women between 18-64 in the workforce will continue to grow. Over half of all women between these ages now work outside the home, and by the end of this decade, more than 70% are expected to do so.

Appendix C

The Impact of the Technological Revolution

The rapid changes in technology will only increase in the coming years, as will its impact on all American's lives. The following represent a few examples:

- The computer and its component industries are showing remarkable growth; this, in turn, will impact greatly on existing industries and skill requirements.

- Many routine jobs now performed by low skilled workers will be done by robots ten years from now. Jobs in these 'robotized' industries will require special technical skills, as well as more knowledge and autonomy by personnel in evaluating and responding to complicated technical information.

- The onslaught of the 'information revolution will create a need for workers with competency in computer literacy, statistics, perhaps a foreign language, and skills in engineering and the hard sciences.

- There will be a continued and growing demand for scientists, engineers, and technicians both within business and industry, and within the military.

Appendix D

Changing Defense Needs--Skilled Personnel Key

The most sophisticated weapons systems in the world obviously require the most sophisticated minds in the world to operate and maintain them. What this shows is the importance of highly skilled personnel to meet today's Armed Forces needs: A look at how skills needs have changed and what today's requirements are is relevant:

- In 1945, the Navy required that only 23 percent of its personnel be highly skilled, but by 1980, the role of semi-skilled personnel was sharply reduced, while the percentage of highly skilled personnel jumped to 42 percent. Currently, 70 percent of all Army jobs require some technical training, while 75 percent of Navy jobs require skilled or highly skilled personnel.

- Despite this greatly increased need for skilled personnel, the pool that the Armed Forces currently has to choose from falls short of those needs. In recent years, the military has been forced to rewrite its training manuals from the 11th-grade level or higher to the 8th -grade level or lower. Many are aimed at the 6th-grade level.

Appendix E

CRITERIA FOR ASSESSING MATH/SCIENCE EDUCATION PROPOSALS

- The proposal should be sufficiently comprehensive to include improvement of the quality of instruction in the fields of math, science, communication skills, foreign language, new technologies, guidance, and counseling.

- The proposal should provide for the planning and implementation of programs at the local level.

- The proposal should provide for local evaluation of the progress of program developed by funds from the proposal which requires participation and input from the school board, parents, teachers, appropriate bargaining agents, business, industry, and community.

- The proposal should establish participation requirements for local school districts which voluntarily participate in the program.

- The proposal should not advocate differential pay for any subject matter area.

- The proposal must provide for administration under the Department of Education.

- The proposal must provide for sex equity and equal access to programs.

- The proposal must provide for a research component to provide for improvement in teacher training methods, utilization of equipment, and classroom delivery methods and systems.

- The proposal must provide funds for the higher education community to jointly participate with local education agencies in preparation of the necessary number of qualified teachers to meet the need.

- The proposal's federal dollars for the programs must be directed to the local education agency for program delivery.

- The proposal's funding authorization level must be of sufficient quantity to provide a reasonable expectation of success on a national level.

- The proposal should require that the current level of expenditure for educational programs should not be reduced as a result of funding for the new program.

1/25/83

NEA/GR

The Shortage of Math and Science Teachers: The Problem, Some Solutions

NEA Staff Contributors:
COMMUNICATIONS
AFFILIATE SERVICES
I.P.D.
RESEARCH

The statistics are alarming.

- There were 43 states that declared a shortage of secondary math teachers and 42 states said the same about science teachers.
- The number of college students prepared to teach high school math has dropped in the past decade by 77 percent. For science, it is down 65 percent.
- According to a University of Iowa study, more than half of newly employed math teachers nationwide have been employed on an emergency basis because school officials could not find qualified teachers. In California alone, during the 1980-81 school year, licensing agencies issued 19,000 emergency credentials.

The conclusion is obvious: Our nation's public schools face a critical shortage of math and science teachers. And as a result, students in this technological era do not have the opportunity to learn skills that are becoming more crucial every day.

One cause of this teacher shortage is industry's success in "out-bidding" the public schools for the skills and expertise of people proficient in those subject areas. In the 1980-81 school year, for example, the beginning salary offered to bachelor degree candidates in mathematics-statistics was 86 percent higher than the average beginning salary for public school teachers. Even more appalling is the fact that in 35 states today the average salary paid to all teachers—half of whom have an MA and more than 11 years' experience—is lower than the salary that industry offers to brand new math-statistics graduates.

Translating these statistics into dollar amounts means a new teacher with a bachelor's degree earns $11,758. If that same person used his or her skills in computer science, the salary would be $18,864. If he or she became a mechanical engineer, it would be $22,584. And so it goes.

The fierce competition for talented and qualified personnel is escalating as industry tries to win over would-be teachers—and many teachers now in the classrooms—with superior salaries, benefits, and working conditions.

One of the solutions to this crisis now being seriously considered is the use of differential pay to attract and hold teachers in [illegible] science, that is, to pay teachers of those subjects more money. NEA emphatically opposes this idea., Historically, the Association has worked for salary schedules that are based on objective criteria and that offer equal pay for similar work.

All teachers perform the same basic function in their jobs. Teaching is based on a core of educational principles and calls for its practitioners to use similar skills—whether they happen to be art or history or science teachers. NEA believes then, that teachers' salaries should be based on the formal level of professional preparation and teaching experience, not on the teachers' sex or race or even the subject or grade level taught.

Paying math and science teachers on a higher salary scale suggests that those academic disciplines are more important than other subjects. Even the scientific community would hesitate to make such an arrogant and pedagogically unsound assertion.

Added-pay schemes fail to take into account two fundamental considerations: why people enter teaching and why they remain in it. Virtually every available study shows that people enter the field primarily because they want to work with young people. The same studies reveal that many leave because of inadequate time to teach and because of other factors that are not directly related to salary. Obviously, salaries for all teachers must be raised, but there are other ways of making teaching more attractive than simply paying more to teachers who are—perhaps only temporarily—in short supply. Class size must be made manageable, nonprofessional duties must be reduced, and teachers must be given time to pursue courses and other professional development activities to help them improve their teaching and their sense of self-worth. These changes cost money, but money that will aid all teachers—and students—not only a select few.

Richard Duschl of the Maryland Association of Science Teachers does not think differential pay can be justified from another point of view: workload. "In terms of time on task," he says, "English teachers have the heaviest workload. How can you say one area is more important than another?"

Even if it would alleviate the math and science teacher shortage, the proposed solution creates more problems than it solves. One would be deciding who would get the supplement. Only teachers of advanced high school mathematics such as algebra, trigonometry, calculus? What about the elementary and middle school teachers who teach math and general science (and thus prepare students for advanced courses) as part of their regular day?

An additional thorny issue is how much money it would take to induce teachers to enter—and remain—in the classroom. Should the pay be comparable to salary offers being made by private industry? If so, where would the money come from? From funds that could otherwise be used to improve salaries for all teachers? The Houston, Texas, schools are offering newly recruited teachers in science and math $2,000 more than other new teachers. This incentive, however, only begins to bridge the $5,500 starting salary gap between private employment and teaching.

But an even more critical issue is how differential pay would affect morale in the public schools. Everyone understands the symbolic significance of pay as a measure of status in the workplace and in society as well. What would school boards who pay math and science teachers more be saying to their elementary teachers, to their foreign language teachers, to their counselors and librarians? How would they defend the inequities?

Favored status for a few teachers would likely undermine the cooperation and collegiality among *all* teachers. It would seriously harm the critical ways in which a faculty works together for the good of students. Math and science teachers—who perform the same function as those in other disciplines—would be set apart and viewed as a privileged class.

"If there's a caste system within our own faculties," says Gerald Piel, publisher of *Scientific American*, "we're not going to get their (teachers') concerted effort to do what's best for growing young people. It's vile to have the market process from the outside tearing the education community apart. In a civilized society for industry to have first claim on our country's talent shows something is wrong. Where's the value put on the arduous task of education?"

Clearly, alleviating the shortage of math and science teachers does not lend itself to a quick-fix solution or a snappy panacea. So rather than focusing on this superficially attractive suggestion of differential pay, we would do better to look at more carefully thought out, productive approaches to solving the problem.

What alternatives does NEA endorse? The answer is that the Association will support ideas which square with the principle of equal pay for equal work and equality of educational opportunity for all students. Such ideas must be funded without significant impact on the funding for both salary and nonsalary improvements for teachers generally.

One obvious solution is to "reeducate" today's surplus teachers to fill the math and science vacancies. As a result of tight school budgets and declining enrollments, many excellent teachers have lost their jobs. Particularly affected have been beginning teachers, those in their first years of employment. So why not tap their talents and commitment to help fill the math/science gap?

It's unrealistic to assume that any RIFfed teacher would want to or even feel comfortable being retrained as, say, an advanced science teacher. But a "ladder" approach to the retraining might work. A social studies teacher, for instance, might prepare him or herself to teach general science—and the general science teacher would get additional training in order to become certificated in physics or chemistry.

Who would pay for this additional schooling? There are several possibilities. One is for the local districts or states to offer grants to teachers willing to expand their areas of certification. Another is more federal support for math and science education.

The federal government's commitment to science education, research, and development has been declining since the late 1960's. In addition, federal support for teacher training institutes and curriculum development dropped off dramatically in the 1970's and virtually disappeared in the ensuing years.

One excellent program that has been hurt by recent federal budget cuts has been the National Science Foundation's summer institutes for math and science teachers. We should be providing more, not fewer, opportunities like this to our public school teachers.

The NEA-backed American Defense Education Act (ADEA) would be another good way to meet the shortage of math and science teachers. It would also bring new information about math and science to the public schools across the country.

Senator Gary Hart (D-Colo.), chief sponsor of the ADEA in the Senate, says the intent of the bill—as with the National Defense Education Act in 1958—is to help schools improve critical education programs in mathematics and science, as well as in foreign languages, guidance and counseling, and the new technology. One component of the bill deals with in-service training for teachers which could be used for those who are willing to renew and expand their expertise.

If we expect to increase the number of math and science teachers in the years ahead, we must start promoting the idea now with today's high school and college students. Cancellable loans or scholarships to defray the cost of college education in math/science would be an incentive to enter the field. There could be a stipulation that accepting the money means spending a specified number of years teaching math or science in the state and [illegible] recipient must reimburse the [illegible] if this condition is not met.

Some incentives to draw and keep math and science teachers in the public schools could apply to other teachers as well. Many teachers would benefit, for example, if industry employed more teachers during the summer in their fields of interest. Many teachers would welcome the change to interact with their professional colleagues, update their knowledge base, and enjoy the security of guaranteed income for the summer.

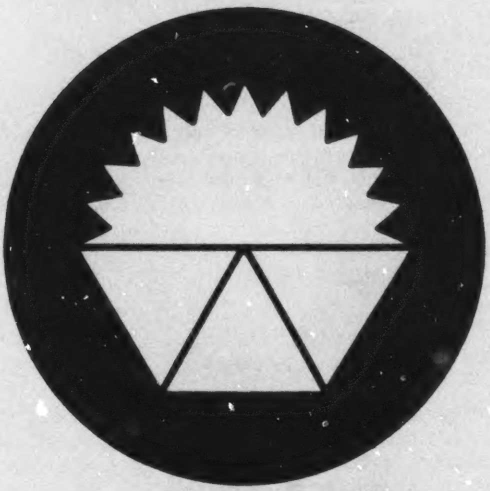
Plans to address the present problem should not ignore the demands and desires of one group that has a vested interest in the public education system—namely parents.

Teachers in all subject areas could both help their own salary crunch and demonstrate their responsiveness to parental concerns by instituting summer tutoring programs. Many parents would like their children to have the chance to gain extra skills or get help in a weak subject area. Local school boards could support the program by providing office space and secretarial support, as well as by officially endorsing the effort.

While recognizing the critical shortage of math and science teachers, we must also realize that the problem doesn't end there. Inadequate salaries are forcing teachers in all subjects to seek jobs where they feel their efforts are being fairly compensated and their profession given due recognition.

Comparisons of teacher salaries to those paid other workers with similar education and training show that teachers in most parts of the country are underpaid by thousands of dollars a year. No wonder, then, that dedicated teachers in *all* fields are leaving the profession for higher paying jobs.

We have not paid our teachers adequately up to now. For years we've had a captive job market among the best, the most intelligent women. Among the best, the most intelligent blacks and other minorities. These groups had few other job options—education was one of the most attractive careers open to them. But now the barriers to other professions are beginning to come down. So we must entice these people into the teaching profession, pay them enough to keep them there, and provide support and recognition commensurate with their contribution to the nation's children and the nation's future.



the north carolina school of
science and mathematics

the challenge

In our commitment to provide better educational opportunities for all to achieve their fullest potential, we must also be careful that in the process we do not neglect or discriminate against, or forget our responsibility to our gifted and talented upon whom all of our futures may depend.

James B. Hunt, Jr.
Governor, State of North Carolina

This nation was not founded, developed and nurtured on a system of mediocrity and surely, it will not continue if we do not begin to develop our greatest minds. We have become so intent on a middle standard that we may lose sight of the fringes, especially that leading edge from whence comes our leaders in scientific fields.

Larry T. Ivey
Superintendent,
Bertie County Schools

We are a scientific civilization. That means a civilization in which knowledge and its integrity are crucial. Science is only a Latin word for knowledge . . . Knowledge is our destiny.

from *The Ascent of Man*
by Jacob Bronowski

The commitment of the State of North Carolina to excellence in education at all levels has an expanded vision. On June 16, 1978, at the request of Governor Hunt, the General Assembly established the North Carolina School of Science and Mathematics. This residential school for gifted and talented high school boys and girls with strong interests and unusually high potential in science and mathematics, located in the heart of the Research Triangle area of North Carolina, presents a *challenge* of attainment of educational excellence to its students, to their parents, to the faculty, as well as to the educational, scientific, and civic communities throughout the state and nation.

The accepting of this challenge and the fulfilling of its goals will advance scientific and mathematical leadership into the 21st Century.

students

Students selected for the School are *challenged* by a curriculum and faculty which will stretch their capacity to learn to its limits. These students will:

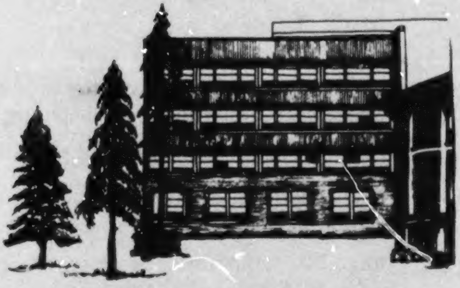
- be selected on the basis of potential to succeed
- have high interest in science and mathematics and a willingness to learn how to apply these fields to the needs of society
- have an inner discipline and outward commitment to inquiry with an appreciation of the joy of learning
- be independent learners and thinkers
- come from all socio-economic and ethnic groups
- have the opportunity to interact with a broad array of other students and adults of outstanding ability

- be exposed to a sensitive and stimulating environment where the opportunity for experiences not possible elsewhere will abound
- become contributing members of a unique living/learning community through regular work and service to school and community.

parents

Parents who make the decision to permit their son or daughter to attend the School are *challenged* by the opportunity to be a necessary partner in the growth of this demanding educational concept. These parents will:

- recognize the high potential of their young people and want it to be enhanced and developed
- be part of the counseling process which admits their children to the School and works closely with them thereafter in their emotional, physical and intellectual development
- be invited to participate in the activities of the School and experience first-hand the excitement of extraordinary academic and cultural programs.



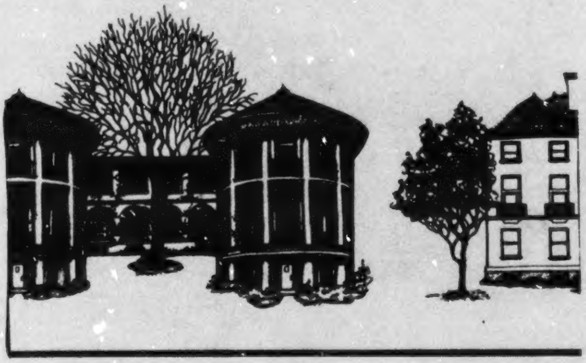
director

It is a great personal challenge to have been selected to lead the School in these formative years. The inspiration of Governor Hunt, the support of the General Assembly, and the involvement of the Board of Trustees provide a solid base on which to build the School. This school will serve education in the way that a surveyor's bench mark serves the mapping of uncharted territory; a fixed point from which the teaching of the gifted and talented can establish new directions into the educational landscape of the future.

Charles R. Eilber
Director

The director:

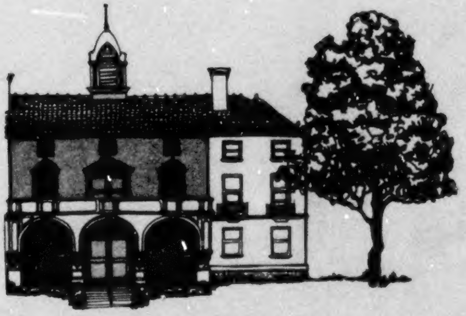
- establishes a climate of enthusiasm, energy, creativity, and inquisitiveness in which new *challenges* will continuously unfold
- points the way to the future for the School with vigor and the determination that its students can make an impact on the future
- brings together all of the complex human and material resources needed to create and maintain a school of the highest standards
- encourages the development of character together with academic achievement.



faculty and mentors

A distinguished faculty, enthusiastic about working with the students in and outside the School, supplemented by highly skilled individuals and consultants from industry and education for curriculum enrichment, course specialization and research, is *challenged* to meet the total needs of the students. These teachers and mentors:

- are selected for knowledge of science, mathematics, the arts and humanities, and their ability to relate effectively to questioning young minds, and the ability to assist in the development of well rounded individuals
- have the qualities to which young people will look for inspiration and guidance
- share with resident counselors the responsibility of providing for students a home away from home
- are creative and flexible in setting of learning objectives and the ways in which they are achieved
- are continuing their own educational and scholarly development.



residential life staff

Chosen for its ability to guide the personal growth of young people, the residential life staff is *challenged* to provide a supportive environment for students in which co-curricular activities are treated with the same importance as academic ones. Because development of total human potential is essential to the development of intellectual potential, the staff:

- provides counseling and guidance sensitive to individual needs
- develops social, recreational, and cultural activities to satisfy a broad range of interests
- provides for health services, food services, and other necessities essential for human personal care
- supervises activities within residence halls to maintain a homelike and responsible environment.

the larger community

A unique *challenge* exists for neighboring institutions that recognize the special nature of the North Carolina School of Science and Mathematics. They have agreed to work with it in the creation of a sensitive and productive program relating the School to the larger environments they represent. Close working relationships have been developed with nearby universities and the many outstanding scientific and cultural institutions in the Research Triangle Park including the National Center for the Humanities. In addition, cooperative arrangements with local groups of health, religious, civic, cultural, and athletic orientation enable a sharing of facilities and knowledge that will expand the concept of the School to and through the community.

This innovative residential School for unusually talented students is an independent part of the public school system. Educators and citizens are encouraged to participate in the *challenge* of creating a program that will, in time, upgrade the quality of science and mathematics everywhere. Through the early identification of gifted and talented boys and girls and the wide involvement of teachers and supervisors in an extensive offering of workshops and seminars during the summer months, when the regular term students are back home, the benefits of this unique living/learning environment are shared with every cooperating school unit.

the campus

The North Carolina School of Science and Mathematics is a *challenging* place not just because of any particular combination of bricks, tile and mortar in the beautiful 15 building—27 wooded acre campus given the state by the people of Durham County, but because of the interaction of the students and the extended faculty in the much larger community where talents, enthusiasm and spirit are shared.

The School is a twenty-four hour educational community. It serves best those young people who want, or can be encouraged to want, to use their minds and bodies well. The living/learning experience is intensive. The total immersion of the residential experience supports growth and learning continuously.

contributors

Individuals, foundations, corporations and other private enterprises are *challenged* to join with federal and state agencies in providing the financial support for the School. While tuition, room and board are supplied without cost to all North Carolina students accepted, all students will contribute to the cost by a rotation system of at least eight hours of work and service each week of residence. The self discipline and sense of community generated are as important as the savings in operational costs. Our youth are our legacy, an extension of the faith of humankind. We cannot fail the *challenge* to provide every possible resource to assist the gifted and talented in becoming inquiring, informed, visonary and humane. That is a school's, indeed, society's mission.

Director Charles R. Eilber on campus with student

state

The continuing *challenge* to the State of North Carolina is one of meeting a pressing concern about our educational system. In recognizing this need Governor Hunt, has pledged that . . .

North Carolina will continue to strive for excellence in all of its schools and to meet the needs of all of its students including exceptional children—both the handicapped as well as the gifted and talented. Mediocrity is not a goal of a democratic society and the new School of Science and Mathematics can be one model, as well as a symbol, of the excellence we seek for all of our schools. The best our society can offer is easier to strive for on a large scale if we can first behold it in microcosm.

Livingston Biddle, the Director of the National Endowment for the Arts has recently suggested that "the state of the arts is North Carolina." It is time for institutions like the North Carolina School of Science and Mathematics, committed to a relentless pursuit of excellence in science, to help North Carolina become known everywhere as *the state of arts and sciences.*

for further information

on how you can be a part of this *challenging* undertaking write to the Director, North Carolina School of Science and Mathematics, West Club Boulevard, Durham, N. C. 27705.

trustees

The Board of Trustees has a continuing dedication to the *challenge* of fulfilling the vision and aims of the North Carolina School of Science and Mathematics.

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Attorney and Chairman,
Environmental Quality
Committee of
Natural Resources
Law Section,
American Bar Association

the north carolina school of science and mathematics

a profile
1983

The North Carolina School of Science and Mathematics is a public, residential, coeducational high school for juniors and seniors with exceptionally high intellectual ability and commitment to scholarship. It was established by the North Carolina General Assembly in 1978 to provide challenging educational opportunities for students with special interest and potential in the sciences and mathematics. There is no charge for tuition or room and board.

The School opened in September 1980 with its first class of 150 juniors, a sample of the many talented and highly motivated students in North Carolina. While students vary in their backgrounds, representing the diversity of North Carolina's population, they are similar in their motivation to achieve academically and in their determination to prepare for professional careers and scientific leadership.

In the fall of 1982, nearly 400 eleventh and twelfth grade students will be living and learning at NCSSM.

campus and community

The school is located in the Research Triangle area on the 27 acre campus which was formerly the home of Watts Hospital, a long-time leader in the medical community of North Carolina. Close working relationships have been developed by NCSSM with nearby universities and many outstanding scientific and cultural institutions situated within a 30-mile radius.

selection of students

Students are selected during their tenth grade year through a highly competitive process that reveals keen interest in science and mathematics and reviews standardized test scores, past academic performance, the home school's assessment of student characteristics, personal interviews, individual student essays, the degree of community involvement and number of out-of-school interests and accomplishments.

An admissions committee, composed of North Carolina residents who are leaders in the scientific and educational communities and members of the NCSSM staff, reviews all data and makes selections.

faculty

The faculty of NCSSM is comprised of professionals with advanced degrees in their disciplines as well as extensive experience as teachers. All have master's degrees and forty-six percent have doctorates. This core staff is supplemented by mentors and consultants from throughout the scientific community of the state and the nation.

instructional program

The instructional program at NCSSM is designed to develop within the individual student not only a greater knowledge and sophistication in science and mathematics but also the ability to relate to human values within the society. Special attention is given to the impact of new technology on values and society. Minimum requirements for graduation include the following units taken over a student's high school career.

4 English
4 Mathematics
4 Science
2 Social Science
2-3 Foreign Language (number dependent on competence upon entry)
1½ Physical Activity & Wellness
3½ Electives

JUNIOR GRADES (CLASS OF '83)

	Percent of Total Grades
A = Outstanding Achievement	42.4%
B = Superior, meets all course requirements	43.2%
C = Acceptable, minimally meets course requirements	13.6%
D = Unsatisfactory, no NCSSM credit	.8%

STANDARDIZED TEST PERFORMANCE

CLASS OF 1982

SAT: CURRENT SCORES* (N=138)

	VERBAL		MATH
Mean:	575	Mean:	648
Median:	560	Median:	600
Mode:	560	Mode:	630

CLASS OF 1983

	VERBAL MEAN	MATH MEAN
PSAT/NMSQT: (N=151)	58.3	65.1

SAT: CURRENT SCORES* (N=154)

	VERBAL		MATH
Mean:	566	Mean:	624
Median:	570	Median:	620
Mode:	590	Mode:	670

CLASS OF 1984

SAT: NCSSM ADMISSION SCORES* (N=228)

	VERBAL		MATH
Mean:	523	Mean:	587
Median:	520	Median:	600
Mode:	520	Mode:	630

*NCSSM requires students to take the SAT during the tenth grade as one of its admissions criteria. Most students then take the SAT again during the junior or senior year. "Current Scores" are scores on the most recent test for each student. "Admission Scores" are those taken in the tenth grade prior to attending the school.

ADVANCED PLACEMENT EXAMINATIONS: MAY 1982

N=135 No. of Examinations=196

	5	4	3	2	1
American History	7	16	3	3	·
Biology	20	22	7	·	·
Chemistry	7	7	12	5	1
European History	·	·	1	·	·
French Language	·	·	·	·	·
French Literature	2	1	1	·	·
Calculus AB	·	2	5	5	·
Calculus BC	16	15	12	5	1
Music Theory	2	1	1	·	·
Physics B	·	·	·	2	·
Physics C: Mechanics/ Electricity & Magnetism	5/2	2/1	5/3	1/2	/1

COLLEGE ACCEPTANCE AND MATRICULATION: CLASS OF '82 (N=133)

CLASS OF 1982 COLLEGE ACCEPTANCES AND SELECTIONS

Name of Institution	Number in Class Accepted	Number in Class Enrolled
	1	
Allegheny College	2	1
Appalachian State University	1	
American University	1	
Atlanta University	3	
Boston University	1	
Brown University	1	
Carlton College	1	1
Carnegie-Mellon University	2	1
Clemson University	1	
Columbia College of Columbia University	12	6
Cornell University	1	
Dartmouth College	13	8
Davidson College	48	17
Duke University	2	1
East Caroline University	1	
Emerson College	2	1
Emory University	1	1
Erskine College	1	
Florida A&M University	1	1
Furman University	1	
Georgetown University	0	3
Georgia Institute of Technology	1	
Hampden-Sydney College	1	
Hampshire College	1	
Hampton Institute	4	3
Harvard-Radcliffe College	1	
Harvey-Mudd College	1	1
Haverford College	4	1
Howard University	2	
Johns Hopkins University	2	
Johnson C. Smith University	1	1
Livingstone College	1	
Mars Hill College	2	
Meredith College	1	1
Massachusetts Institute of Technology	1	1
Michigan Technological University	2	
Morehouse College	1	1
New College of the University of South Florida	2	1
North Carolina A&T State University	53	30
North Carolina State University	6	1
Northwestern University	1	
Oberlin College	1	
Presbyterian College	5	2
Princeton University	1	
Purdue University	6	2
Rensselaer Polytechnic Institute	2	
Rice University	2	1
Spelman College	2	
Stanford University	1	
Stevens Institute of Technology	1	
Swarthmore College	1	
Syracuse University	1	
Texas A&M University	2	1
United States Air Force Academy	2	1
United States Military Academy	2	1
United States Naval Academy	1	
University of California, Davis	2	
University of Chicago	1	
University of Dallas	1	
University of Delaware	1	
University of Georgia	1	
University of Miami	1	
University of Michigan	61	29
University of North Carolina at Chapel Hill	3	1
University of North Carolina at Greensboro	4	1
University of Notre Dame	1	
University of Rochester	1	
University of South Carolina	1	1
University of Tennessee	5	
University of Virginia	3	1
Vanderbilt University	2	1
Virginia Polytechnic Institute and State University	14	7
Wake Forest University	2	
Washington University—St. Louis	1	
Williams College	1	
Wingate College	2	1
Wofford College	1	
Worcester Polytechnic Institute	4	1
Yale University		

Each student must also

- successfully complete two years of Work Service.
- successfully complete one year of Community Service.
- demonstrate computer proficiency.

This core curriculum is supplemented by special seminars and symposia throughout the year.

Individual programs are designed to ensure each student's thorough grounding in mathematical skills and concepts and in verbal skills, including writing. Students are urged to select an advanced sequence in at least one subject and also to sample several areas of study through choice of electives. Students have the opportunity to prepare for Advanced Placement examinations if they wish. During the 1982-83 school year 135 students sat for Advanced Placement examinations in Biology, Physics, Chemistry, Calculus, American History, French Literature, French Language, European History and Music Theory.

The Fine Arts Program offers the students the opportunity to discover and develop their talents. Courses include music, both vocal and instrumental, as well as ceramics, photography and media production. Many students follow these interests independently through individual instruction outside their scheduled studies and through the cocurricular program.

Seniors are encouraged to take part in the Mentor Program or to undertake independent research projects.

Students who elect the Mentor Program spend three to five hours per week in laboratories assisting professional researchers in Triangle area universities, institutes and industries.

residential program

Because all students reside on campus there are rich opportunities for evening tutorials, guest lectures, off-campus field trips and visits to local educational and scientific institutions.

The school offers a comprehensive residential life program, including student government, clubs, publications, music and athletics.

Through the Athletic Program students have the opportunity to compete both in intramural and interscholastic activities.

Through the Work Service Program, a student spends an average of four hours a week working on campus (i.e., tutor, computer aide, housekeeper, dorm assistant).

Through the Community Service Program, each junior contributes an average of three hours a week in volunteer work. This program develops within the student a greater sensitivity to the problems and needs of the community in which he or she resides.

evaluation

Students at NCSSM are evaluated quarterly and are given a letter grade. Because the school population is highly motivated and was selected through a competitive admissions process, the majority of students will be clustered near the top of the grading scale. It would neither benefit the students nor clarify the character of the academic program to engage in ranking. However, statistics for the *junior year* of the current senior class are provided in an effort to help others in interpreting the academic progress of the students. (Please refer to insert.)

For additional information, please telephone or write:

Charles R. Eilber Director (919) 683-6656	Rena R. Lindstrom Head, Guidance & Counseling (919) 683-6532	Richard B. Bryant, Jr. Coordinator, College Planning (919) 683-6532

1912 West Club Boulevard and Broad Street, Durham, North Carolina 27705

The North Carolina School of Science and Mathematics

ACADEMIC RECOGNITION AND AWARDS PROGRAM

Bryan Center University Cinema
Duke University
June 11, 1982

FANFARE
North Carolina School of Science and Mathematics
Brass Ensemble
Randolph Foy, Conductor

WELCOME
Charles R. Eilber, Director

PRESENTERS
Sarah W. Hamilton, Academic Dean
Charles R. Eilber, Director

SCHOLARSHIPS

NATIONAL

NATIONAL ACHIEVEMENT CORPORATE SCHOLARSHIP FOR OUTSTANDING NEGRO STUDENTS
TO: Lisa A. Dixon (Kodak Corporation)
Nathaniel Dobson, Jr. (Weyerhaeuser Corporation)
Otis D. Raiford (Dow Corning Corporation)
Tricia L. Townes (Atlantic Richfield Corporation)

NATIONAL ACHIEVEMENT COLLEGE SCHOLARSHIP
TO: Ellis H. Smith, II (Morehouse College and Howard University)

NATIONAL ACTION COUNCIL FOR MINORITIES IN ENGINEERING SCHOLARSHIP
TO: Nicole F. Brown
Percil Watkins

NATIONAL MERIT CORPORATE SCHOLARSHIP
TO: John B. Armitage (Burroughs Wellcome Company)
Richard O. Chapman (Sperry Corporation)
Charlotte N. Chiu (Rockwell International Corporation)
Richard V. Everette (Loews Foundation)
Paul B. Habit (Xerox Corporation)
Sarah B. Krigman (The Nestle Company, Inc.)
Andrew G. Philpot (SEM Corporation)
Leigh A. Proctor (Celanese Corporation)
Keith S. Promislow (Celanese Corporation)
Alexander J. Rimberg (General Foods Company)

NATIONAL MERIT CORPORATION $1,000 SCHOLARSHIP
TO: Jassim A. Al-Saadi, Jeffrey L. Haines, John G. Humphrey,
Christopher D. Staffa, Shauna S. Tilly, J. Mark Williams

NATIONAL MERIT COLLEGE SCHOLARSHIP
TO: Naomi Y. McCormick (Duke University)
Richard E. Troutman (Georgia Institute of Technology)

1982 PRESIDENTIAL SCHOLARSHIP
TO: Anita R. Warner (Gerald Dodge Foundation)

MILITARY

UNITED STATES AIR FORCE ACADEMY APPOINTMENT
TO: D. Michael Riddie, Karon L. Uzzell

UNITED STATES MILITARY ACADEMY APPOINTMENT
TO: Thomas C. Gilchrist, Jr., D. Michael Riddle

UNITED STATES NAVAL ACADEMY APPOINTMENT
TO: Thomas C. Gilchrist, Jr., Gerald A. Sherman

UNITED STATES AIR FORCE ROTC SCHOLARSHIP AT GEORGIA INSTITUTE OF TECHNOLOGY
TO: Robert D. Emory (Presented by Major Richard Dehay, Assistant Professor,
Aerospace Studies, Duke University)

UNITED STATES ARMY ROTC SCHOLARSHIP AT HOWARD UNIVERSITY
TO: Thomas C. Gilchrist, Jr.

UNITED STATES NAVY ROTC SCHOLARSHIP AT CORNELL UNIVERSITY
TO: Douglas A. Appleyard

COLLEGE/UNIVERSITY

THE AMERICAN UNIVERSITY PRESIDENTIAL SCHOLARSHIP
TO: Herman T. Goins, Jr.

CLEMSON UNIVERSITY R. F. POOLE ALUMNI SCHOLARSHIP
TO: Melanie S. Smith

DAVIDSON COLLEGE
EDWARD CROSLAND STUART SCHOLARSHIP
TO: Shelley C. Lineberger
LUNSFORD-RICHARDSON HONOR SCHOLARSHIP
TO: Julia L. Danek and Thomas C. Gilchrist, Jr.

DUKE UNIVERSITY
ANGIER BIDDLE DUKE MEMORIAL SCHOLARSHIP
TO: Janet R. Leatherwood, Alexander J. Rimberg, Shauna S. Tilly
NORTH CAROLINA HONORS SCHOLARSHIP
TO: John B. Armitage, Richard O. Chapman, Ellen L. Dixon, Miles D. Duke, Amy C. Gilbert, Jeffrey L. Haines, Daryll E. Hendricks, Frank T. Hollander, Peter B. Lewter, Jr., Naomi Y. McCormick, Jeffrey A. Parker, Gary A. Steele, Otis E. Tillman, Jr., Dean S. Thompson
REGINALDO R. HOWARD MEMORIAL SCHOLARSHIP
TO: Otis E. Tillman, Jr.

EAST CAROLINA UNIVERSITY ALUMNI HONOR SCHOLARSHIP
TO: Amy Y. Mustian (Presented by Dr. Angelo Volpe, Dean of the College of Arts and Sciences, ECU)

EMORY UNIVERSITY ROBERT WOODRUFF SCHOLARSHIP
TO: Tricia L. Townes

ERSKINE COLLEGE E. B. KENNEDY SCHOLARSHIP
TO: Saralyn R. Hawkins

FURMAN UNIVERSITY HONOR SCHOLARSHIP
TO: Elizabeth A. Kennedy

HAMPDEN-SYDNEY COLLEGE ALLAN SCHOLARSHIP
TO: Herman T. Goins, Jr.

MARS HILL COLLEGE PRESIDENT'S SCHOLARSHIP
TO: Robin N. Carter

MEREDITH COLLEGE JULIA HAMLET HARRIS SCHOLARSHIP
TO: Suellen Howell

NORTH CAROLINA A&T STATE UNIVERSITY NATIONAL ALUMNI ASSOCIATION SCHOLARSHIP
TO: Tonya A. Crawford

NORTH CAROLINA STATE UNIVERSITY
COMMITTEE FOR EDUCATION CORPORATION SCHOLARSHIP
TO: Reginald F. Johnson
FRESHMAN RECOGNITION SCHOLARSHIP
TO: Henry D. Kuo
MERIT SCHOLARSHIP
TO: Nicole F. Brown, Sean O R. Campbell, Henry D. Kuo, Amy Y. Mustian, Andrew G. Philpot, Melanie S. Smith, Sherri L. Vesalga
SCHOOL OF ENGINEERING MERIT SCHOLARSHIP
TO: Richard V. Everette

OHIO STATE UNIVERSITY FRESHMAN SCHOLARSHIP
TO: Andrew G. Philpot

SPELMAN COLLEGE
HONORS SCHOLARSHIP
TO: Lisa A. Dixon, Tonya A. Crawford
UNION CARBIDE CORPORATION SCHOLARSHIP
TO: Lisa A. Dixon

THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
AUBREY LEE BROOKS FOUNDATION SCHOLARSHIP
TO: Tonya L. Smith
JAMES M. JOHNSTON SCHOLARSHIP
TO: Kenneth L. Murphy
JOHN MOTLEY MOREHEAD SCHOLARSHIP
TO: A. Bradley Ives, Otis E. Tillman, Jr.
(Presented by Mr. Egbert L. Haywood, Chairman, Durham County Committee)
JOSEPH E. POGUE SCHOLARSHIP
TO: Nathaniel Dobson, Jr., Tricia L. Townes, Karon L. Uzzell

THE UNIVERSITY OF NORTH CAROLINA AT GREENSBORO
KATHERINE SMITH-REYNOLDS SCHOLARSHIP
TO: Beverly L. Robinson

UNIVERSITY OF TENNESSEE ALUMNI ASSOCIATION FRESHMAN SCHOLARSHIP
TO: Thomas P. Yadon

WAKE-FOREST UNIVERSITY
GEORGE FOSTER HANKINS SCHOLARSHIP
TO: Kris L. Carswell, Herman T. Goins, Jr., Elizabeth A. Kennedy
GUY T. CARSWELL SCHOLARSHIP
TO: Richard O. Chapman, Sarah M. Lewis, J. Mark Williams

WOFFORD COLLEGE W. HASTINGS McALISTER SCHOLARSHIP
TO: Mary V. Tatum

CORPORATE, FOUNDATION, ORGANIZATION

ABAWALA SORORITY SCHOLARSHIP
TO: Tonya A. Crawford

AMERICAN BUSINESS WOMAN'S ASSOCIATION SCHOLARSHIP
TO: Robin N. Carter

AMERICA'S OUTSTANDING NAMES AND FACES AWARD
TO: Otis E. Tillman, Jr.

CUMBERLAND COUNTY ASSOCIATION OF CLASSROOM TEACHERS
MATTIE BELL ROGERS SCHOLARSHIP
TO: Michelle C. Zimmer

DELTA SIGMA THETA SORORITY SCHOLARSHIP
TO: Hector W. Cooper
Tonya L. Smith

FORD FOUNDATION 4-H SCHOLARSHIP
TO: Janice M. Parker

IBM CORPORATION T. J. WATSON SCHOLARSHIP
TO: Shauna S. Tilly

INSTITUTE OF NUCLEAR POWER OPERATION SCHOLARSHIP
TO: Thomas P. Yadon

LES QUATORZE CLUB SCHOLARSHIP (KINSTON, NORTH CAROLINA)
TO: Nicole F. Brown

MARTIN-MARIETTA CORPORATION SCHOLARSHIP
TO: Kenneth L. Murphy

NORTH CAROLINA DEPARTMENT OF VETERANS AFFAIRS FOUR-YEAR SCHOLARSHIP
TO: Janice M. Parker

PURCHERSON INCORPORATED SCHOLARSHIP
TO: Robert B. Bennett

WESTERN ELECTRIC FUND SCHOLARSHIP
TO: Andrea M. Wisner

CHURCH

J. T. HAIRSTON MEMORIAL SCHOLARSHIP
TO: Charlene M. Carter

AWARDS AND HONORS*

NATIONAL

NATIONAL ACHIEVEMENT SCHOLARSHIP PROGRAM CERTIFICATE OF ACHIEVEMENT
TO: Lisa A. Dixon, Nathaniel Dobson, Jr., Stephannie M. Jackson, Peter R. Lewter, Jr., Otis D. Raiford, Ellis H. Smith, II, Otis E. Tillman, Jr., Tricia L. Townes

NATIONAL MERIT SCHOLARSHIP PROGRAM CERTIFICATE OF MERIT
TO: Jassim A. Al-Saadi, Douglas A. Appleyard, John B. Armitage, Lee D. Bulwinkle, Sean O R. Campbell, Richard O. Chapman, Charlotte N. Chiu, Julia L. Danek, J. Alex Daughety, Jr., Richard V. Everette, Paul B. Habit, Jeffrey L. Haines, Susan A. Herbert, John G. Humphrey, A. Bradley Ives, Janet K. Leatherwood, Robert H. Lee, Sarah M. Lewis, Naomi Y. McCormick, Kenneth L. Murphy, Jeffrey A. Parker, Jamie C. Pate, Andrew G. Philpot, Keith S. Promislow, Alexander J. Rimberg, Eric D. Roush, Larry E. Sigmon, Melanie S. Smith, Christopher D. Staffa, Gary A. Steele, Dean S. Thompson, Shauna S. Tilly, Ward C. Travis, Richard E. Troutman, J. Mark Williams

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*Includes both seniors and juniors

NATIONAL MERIT SCHOLARSHIP PROGRAM LETTER OF COMMENDATION
TO: Beverly J. Adams, Susan C. Anderson, Robert A. Cline, Ellen L. Dixon, Lisa A. Dixon, Miles D. Duke, Karl C. Garrison, III, Amy C. Gilbert, Walter E. Gordon, Grace H. Han, Anthony R. Hefner, Ronald B. Houck, II, Carolyn S. Knowlton, Shelley C. Lineberger, Amy Y. Mustian, Anita R. Warner, Leigh A. Proctor, D. Michael Riddle, Tricia L. Townes, Thomas P. Yadon

UNITED NATIONS PEACE SPEAKING CONTEST
TO: Mark D. Maxwell, First Place Winner

REGIONAL/STATE/LOCAL

CIVITAN ESSAY CONTEST AWARD
TO: Margaret N. Gatling, First Place Winner
Murray A. Abramson, Second Place Winner

EASTERN NORTH CAROLINA SCIENCE FAIR HONORABLE MENTION
TO: Charles R. Young, Kevin M. Clements

MUSIC AWARDS
ALL-STATE BAND: Douglas A. Appleyard, Robert B. Bennett, Ellen L. Dixon, Kurt A. Indermaur, Nathanael L. Miranda, Clifford W. Mercer, Charles R. Weber
ALL-STATE CHORUS: Robin N. Carter, Therese A. Harmon
ALL-STATE ORCHESTRA: Ellen L. Dixon, Kurt A. Indermaur, Hih Song Kim, Clifford W. Mercer, William M. Schwartz, Shauna S. Tilly
NORTH CAROLINA HONORS BAND: Kurt A. Indermaur
NORTH CAROLINA HONORS CHORUS: Thomas C. Gilchrist, Jr., Herman T. Goins, Jr., Janeen L. Vanhooke
NORTH CAROLINA HONORS ORCHESTRA: Hih Song Kim
NORTH CAROLINA MUSIC EDUCATORS VOCAL SOLO CONTEST AWARDS
(Excellent and Superior Ratings)
TO: Robin N. Carter, Thomas C. Gilchrist, Jr., Herman T. Goins, Jr., E. Eugene Murray, Janeen L. Vanhooke

NATIONAL FRENCH CONTEST WINNERS
CERTIFICAT de MERITE CONCOURS NATIONAL de FRANCAIS
TO: Jeffrey L. Haines, Lisa C. Sykes, Tonya L. Smith
CERTIFICAT d'HONNEUR CONCOURS NATIONAL de FRANCAIS
TO: Adam F. Falk, Lisa C. Shouse, Grace H. Han, Anthony R. Hefner, Lisa A. Dixon, David W. White, Leslie D. Reynolds

SOUTHEASTERN REGION
Adam F. Falk, Seventh Place
Lisa C. Shouse, Seventh Place

NORTH CAROLINA	**Position in State**	**Level**
Grace H. Han	Third Place	French 5
Adam F. Falk	First Place	French 4
Anthony R. Hefner	Sixth Place	French 3
Lisa A. Dixon	Eighth Place	French 3
David W. White	Ninth Place	French 2
Lisa C. Shouse	Second Place	French 1
Leslie D. Reynolds	Seventh Place	French 1

NATIONAL SPANISH CONTEST

NORTH CAROLINA	**Position in State**	**Level**
Kelly M. Long	Fifth Place	Spanish 3
Bryan R. Stutzman	Sixth Place	Spanish 3
Jacqueline M. Heder	Eighth Place	Spanish 3
Dana E. Rockett	Tenth Place	Spanish 3
Karen C. Burgin	Eleventh Place	Spanish 3

NATIONAL AND STATEWIDE MATHEMATICS CONTEST
ANNUAL HIGH SCHOOL MATHEMATICS CONTEST AWARD
TO: Adam F. Falk, Highest Scoring Junior in State Competition
ATLANTIC AND PACIFIC MATHEMATICS LEAGUE CONTEST
TO: Frank T. Hollander, Top Scorer, Accepting Award for NCSSM (Highest Scoring Team in Carolina Division)
NORTH CAROLINA MATHEMATICS LEAGUE CONTEST
TO: Adam F. Falk, Accepting Award for NCSSM Mathematics Department (Second in State)
Certificate of Merit Winners: Adam F. Falk, Third Place; Charlotte N. Chiu, Thirteenth Place; Frank T. Hollander, Thirteenth Place
NORTH CAROLINA MATHEMATICS TEAM AND REGIONAL PARTICIPANTS
Hooman Sabeti, Fifth Place; Adam F. Falk, Sixth Place; Jeffrey L. Haines, Eleventh Place; Boyd A. Gregg, III, Fifteenth Place
STATE MATHEMATICS CONTEST
16 Qualifiers of 110 Participants: Robert B. Bennett, Charlotte N. Chiu, Miles D. Duke, Richard V. Everette, Adam J. Falk, Boyd A. Gregg, III, Jeffrey L. Haines, Frank T. Hollander, A. Bradley Ives, Sarah B. Krigman, Keith S. Promislow, Alexander J. Rimberg, Hooman Sabeti, Bryan R. Strutzman, Shauna S. Tilly, Charles C. Yue

NORTH CAROLINA LATIN CONTEST AWARD
TO: J. Mark Williams, Second Place, Advanced Level

NCSSM CHARTER MEMBERSHIP IN NATIONAL FORENSIC LEAGUE
Presentation: Thomas Boddie, NCSSM Debate Team Sponsor
Accepting: Charles R. Eilber, Director

NORTH CAROLINA STATE QUIZ BOWL WINNERS
Eric D. Roush, Adam F. Falk, Thomas P. Yadon, Robin J. Cunningham, Charlotte N. Chiu

OMEGA PSI PHI FRATERNITY (DURHAM CHAPTER), NATIONAL ESSAY CONTEST
Tonya L. Smith, First Place Winner; Elizabeth A. Grainger, Second Place Winner

SCHOLASTIC PHOTOGRAPHY REGIONAL AND NATIONAL AWARDS BY EASTMAN KODAK COMPANY
TO: Barbara A. Birdwell

VETERANS ADMINISTRATION VOLUNTARY SERVICE AWARDS
TO: Tonya L. Smith, Sherri L. Vesalga, Michelle C. Zimmer (177 hours and two years of service);
Saralyn R. Hawkins (100 hours of service); Ronald B. Houck, II (50 hours of service)

VETERANS OF FOREIGN WARS VOICE OF DEMOCRACY ESSAY CONTEST
CERTIFICATE OF MERIT
TO: Dhruva R. Sen, First Place Winner; William E. Fox, Second Place Winner;
Diane A. Barber, Third Place Winner

ROTARY CLUB OF DURHAM YOUTH MERIT AWARD
TO: Shauna S. Tilly and Otis E. Tillman, Jr.

SUMMER OPPORTUNITY AWARDS*

CORNELL UNIVERSITY TELLURIDE ASSOCIATION SCHOLARSHIP
TO: Susan S. Woodhouse

DUKE UNIVERSITY MARINE LABORATORY RESEARCH APPRENTICESHIP
TO: Robin J. Cunningham and Margaret N. Gatling

ENVIRONMENTAL PROTECTION AGENCY SUMMER INTERNSHIP PROGRAMS
CANCER RESEARCH
TO: Regina L. Dobson, Dawn E. Pruden, Leslie D. Reynolds
COMPUTER SCIENCE
TO: Nathaniel Dobson, Jr.

NORTH CAROLINA GOVERNOR'S SCHOOL 1982
TO: Julia L. Baldree, Instrumental Music
Kimberly G. McLaughlin, Drama
Felicia A. Washington, Chorus

NORTH CAROLINA STATE SCHOOL OF DESIGN SUMMER PROGRAM
TO: Cynthia Y. King

ROCKEFELLER FOUNDATION MARINE BIOLOGICAL LABORATORY PROGRAM AT WOODS HOLE, MA
TO: Adrian Lawrence and Leslie C. Reynolds

ST. AUGUSTINE'S COLLEGE STEP IN PRE-MEDICINE
TO: Ellis H. Smith, II

THE UNIVERSITY OF NORTH CAROLINA-CHAPEL HILL, DENTISTRY MINORITY HIGH SCHOOL APPRENTICESHIP PROGRAM
TO: Paula D. McLean

YOUTH FOR UNDERSTANDING'S SUMMER PROGRAM TO JAPAN
TO: Nathanael P. Miranda

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Sarah W. Hamilton, Chairperson
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Jacqueline F. Meadows
Rufus D. Owens
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*Includes both seniors and juniors

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EDUCATION WEEK

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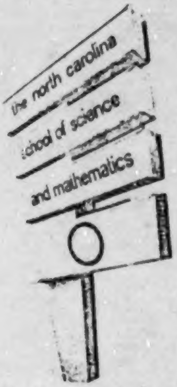

the north carolina
school of science
and mathematics

N.C. School of Science and Math:

"A Flame Burning Brightly"

Innovative Boarding School Is Part of Broader Plan To Bring State Into High-Technology Era

CONCERN over science education grows as the U. S. falls behind other nations in economic productivity. An unusual school of science and mathematics in North Carolina offers one model for helping to deal with the problem.

By Susan Walton

DURHAM, N. C.

The shrill whine of a power saw breaks the stillness of the clear autumn day. Groups of students sit on the steps of a building, talking and waiting for a van that will take them to laboratories and community centers around Durham. Nearby, construction workers install the wiring and plumbing that will transform the gutted third floor of part of the former Watts Hospital into new science laboratories for the only state-sponsored, residential, science and mathematics high-school in the U. S.

Construction—of buildings, programs, curricula, and plans—remains very much a part of the scene as the North Carolina School of Science and Mathematics moves into its second year of operation. Opened in September 1980, the school adopted an ambitious agenda that addressed not only the needs of the 11th- and 12th-grade high-school students who would study there, but also, through workshops and other programs, those of students and teachers elsewhere in the state.

High-Technology Era

The school, which proponents hope will provide the state with a pool of highly trained scientific and technological workers, is also part of a larger effort to bring North Carolina into the high-technology era, according Gov. James B. Hunt.

The school's staff had to build, from scratch, programs that would meet the needs of their several constituencies—teachers and students. The students selected to attend had to adjust to an academically rigorous program, a new group of people, and, for many, their first extended separation from their families. Both groups went about their business accompanied by the publicity that is the lot of "pioneers," and the construction noise that is the lot of people who convert old hospitals into boarding schools.

It was not, the staff and students agree, an easy year.

But, with the first year behind them, they also agree that the ambitious experiment has, so far, been successful. "It would be terribly presumptuous for us to say this is *the* answer," said Michael E. Collins, assistant director and dean for student personnel services. "But it is an answer."

The school's success is visible in tangible ways: 95 percent of the students who came to the school have stayed, as have all the faculty; it has a higher percentage of National Merit Scholarship semi-finalists than any other school in the country (Stuyvesant High School, in New York, has a greater number); many of the students who took the Educational Testing Service's advanced-placement examinations in, for example, biology, achieved the highest possible score; and discipline problems are rare.

Less tangible elements also figure into the picture. Enthusiasm is high. "Challenging" is one word frequently used by both students and staff in describing the school. "Rewarding" is another.

"I think most of them really love it," said Virginia S. Wilson, head of the humanities and social-sciences department and an instructor of social sciences. "They feel very free to be themselves. Given their interests, this school has a great deal of appeal for them."

'Energy and Enthusiasm'

Faculty members also seem content, if extremely busy. "It's a wonderful situation," said C. Stephen Davis, head of the department of mathematics and computer science. "In this environment, you can translate energy into results. They have a real energy and enthusiasm for learning that enables you to overcome problems and frustrations. It's what makes me realize that the idea is really sound."

First proposed in the early 1960's by then-Gov. Terry Sanford, the idea for the school began to be realized in 1978, when Governor Hunt succeeded in getting the enabling legislation through the North Carolina General Assembly.

Governor Hunt said, in a recent interview, that he plans "to take North Carolina into a high-technology future," and that the school, as a means of providing highly competent, scientifically trained personnel, is part of that plan. The governor also views the school as a means of remedying some of the problems involved in providing high-quality science education.

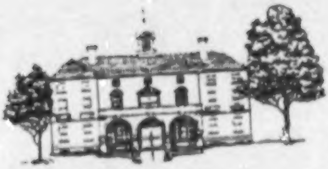
"We have been aware that within our public schools, even in the best situations, we have not truly challenged the brightest young people," he said. "We wanted to put them in a situation where they'd push each other, to challenge them to the maximum.

"We also wanted to stimulate and upgrade math and science in schools across the state," he continued. "We see this school as sort of a flame burning brightly in the middle of our state."

Industrial Transformation

The school, explains H. Broughs Taylor, its director of development, is part of the statewide campaign to transform North Carolina from a rural into an industrial—although not necessarily urban—economy and to attract industry to smaller communities.

"North Carolina is still a rural state," Mr. Taylor said. "That's one reason this school is so needed and so feasible." Though it is the 10th most populous state in the country, he noted, it has no city with a population greater than [illegible].



School and state officials hope also that the school will affect the teaching of mathematics and science in a broader sense. "We will be studying the most effective teaching techniques, what works best," Governor Hunt said. "We hope to be replicated in schools across the state. There are a lot of things that can be replicated in the schools; not all of them will be." It takes money, which not all school districts can provide, he said, but it also takes more than money.

Staff from the school will also have direct contact with personnel from other schools around the state. Last summer, the new institution sponsored a workshop on "computers in the classroom" for science and mathematics teachers. The response was overwhelming; a workshop originally planned for 30 teachers eventually included 151.

For many, Mr. Davis said, it was their first encounter with computers, and they found it difficult and challenging. "No one threw in the towel," he said, and many returned to their schools as advocates of computers.

A high percentage of these schools now have computers, he said, some purchased by principals who had been reluctant to invest in the equipment because none of the teachers knew how to use it. School officials plan another beginning workshop this summer, which will be followed by a more advanced course for those who took last summer's course.

Model School Offers Solutions

For educators in other states, especially those where most of the population lives in small towns or rural areas, North Carolina's science and mathematics school may be a model; it is one of many possible solutions to the problem of providing gifted students with intensive training in science and mathematics.

Mr. Eilber outlined some of the factors that educators in other states might want to think about should they contemplate following North Carolina's example.

"Make sure that you get as broad a base of support—political and financial—as possible," Mr. Eilber counseled. Such support is crucial, he said, in working out the important issues in planning a school of this kind—the cost of the residential program, for example. "You must justify the residential program, and provide resources the students couldn't get no matter what," he said. "It isn't just a day school, but a commitment to total education."

In addition, Mr. Eilber said, development of such an ambitious program for an alternative school requires "a real dedication by someone in the public sector," someone—Governor Hunt in this case—who can convince the state legislature to put the necessary funds into the school.

Also, Mr. Eilber said, "Hire very qualified, experienced people."

Moreover, he suggested, North Carolina's new school—and others like it—must be prepared to answer the "cries of elitism." People worry, he cautioned, that the students will become snobs.

"That hasn't happened here," according to Mr. Eilber. He said work and community-service programs help to give students "a grasp of reality. They don't see themselves as a little island of privilege."

Governor Hunt agrees that elitism is not a problem, nor is it a criticism leveled at the state's science high school. "I think we're well past that," he said. "Now, quite the reverse is true. Teachers and administrators are sort of competing to have their best students get into the school."

The admissions process is another important factor in determining students' success, Mr. Eilber said. The school uses Scholastic Aptitude Test scores, administered no later than January of 10th grade, but they also use a test of nonverbal reasoning ability, which is one way of circumventing possible problems of cultural bias. School officials visit as many districts as they can to talk to students, parents, and educators. In addition, students write supervised essays; finalists are brought to the school and interviewed there.

Currently, the school's officials are in the process of gathering applications for next year. By the time the new class arrives, the first class of seniors will have graduated; most will have gone on to college. Eventually, they may join a high-technology industry in North Carolina.

"I don't know if we can make an impact," Mr. Davis said, "but I can't think of a better way to try."

Consequently, most North Carolina schools are relatively small, with few resources to provide advanced mathematics and science courses for at most a handful of accelerated students. But by bringing the most gifted students, who now come from 85 of North Carolina's 100 counties, together in one facility, the advanced course offerings become financially feasible, Mr. Taylor suggested.

"These kids come from all over the state," Mr. Collins said. "But we do feel that there's a special place for the rural youngster," who might otherwise not have the opportunity to take advanced math and science courses. "This is an opportunity for these youngsters to really enhance their talents," he added, noting that for students from urban areas, "magnet" schools that offer a rigorous academic curriculum may accomplish the same thing. "For a kid from a rural area, the idea of a magnet school just isn't real," he said.

The school has not, as some critics feared, "siphoned off" all the good students, leaving other state high schools with the mediocre students. Charles R. Eilber, director of the science and math school, points out that this is impossible simply in terms of numbers, since the school now has only 300 students and will have, at most, 900 within several years. "We have a sample of the top students," he said.

The student body is also fairly evenly balanced in terms of sex and race: 55 percent are male, 45 percent are female, and 22 percent are black, native American, or members of another ethnic minority group.

However, providing a specialized science education at the new facility is not cheap, officials say. It costs about $6,000 per student per year—about three times the state's average per-pupil expenditure.

Computing costs for each student, however, is complicated by one-time expenses like beds, desks, and the other accouterments of a residential school. The students pay no tuition or room and board.

But the costs have been eased to a degree by donations from the private sector.

"It's a good model in public-private partnership," Mr. Eilber said. The state pays the basic costs, he said, but private donations have provided a number of important supplements. The school's VAX-750 computer—one of its most heavily used facilities—was paid for almost entirely by a private grant.

Rigorous Courseload

The juniors and seniors who attend the school take a rigorous academic courseload and also participate in a school-work program and a community-service program, each of which takes up about five hours a week. These activities are included, Mr. Collins said, because school officials believe that it is important that students have nonacademic experiences as well.

Many also participate in a "mentor experience," in which they are matched with a researcher from a local academic or industrial lab.

In the sciences, students are expected to take at least one course in each of the areas of biology, chemistry, and physics. Courses offered include advanced biology (virtually all have taken first-year biology before they arrive), organic chemistry, analytical chemistry, two levels of physics (pre-calculus and calculus), as well as some physics electives (astrophysics and modern physics) according to Charles V. Britton, head of the science department. The courses are taught, Mr. Britton said, from "a problem-solving point of view."

In mathematics, the courses range from an accelerated second-year algebra course to calculus BC (the most advanced level of calculus taught in high schools, covering material included in the Educational Testing Service's "BC" level advanced placement calculus test). Students are placed in the appropriate course depending on their previous coursework, Mr. Davis said.

In addition to classroom instruction, mathematics students attend a lecture series given by academic and industrial mathematicians.

The goals of the math department, Mr. Davis said, include—besides teaching students mathematics—improving their problem-solving abilities and "nurturing an interest that's already there." The students are enthusiastic, he said. "You don't have to drum it up. It's there."

Both mathematics and science courses emphasize the use of computers, staff members said. Students learn programming, as well as how to use the computer as a tool in science and mathematics. They also learn how to use computers as research tools for on-line searches and other tasks.

The humanities—history, English, foreign languages—receive an equal amount of attention. Students are required to take two years of English, a total of two years of a foreign language (many have had one year before coming to the school), and a year of American studies.

Many go beyond these requirements and many also elect to take art and music. "We want to develop the total personality," said Ms. Wilson. "We're trying to bridge the two cultures."

Science Provides 'Edge'

"Most students, I think, enjoy this end," Ms. Wilson said. "There are a few who would spend all day at the computer terminal, but most students want to keep themselves broad-based." She added, however, that "the reality is that they have to look at the job market. Science will give them an edge."

Ms. Wilson cited the example of one of her students who excels in history but who will probably turn to mathematics as a career. "History is going to make a wonderful hobby," she told her.

In the humanities, Ms. Wilson said, the emphasis is on skills: research, written and oral communication, information retrieval, using computers in the library, and the like.

Students have shown significant gains in all areas, according to faculty members interviewed. "The seniors are remarkably more dedicated to studying than they were last year at this time," said Mr. Britton. "The amount of [unsupervised] academic study in the evenings is much greater."

In mathematics, Mr. Davis said, "their study skills have improved dramatically. It's hard to believe that our seniors were ever where our juniors are." In the humanities, Ms. Wilson said, there is "a definite improvement from last year" in organization, study skills, and other areas.

Not all the students plan careers in science or mathematics, school officials said; many are interested in business, law, or other fields. "We don't see it as missing our mission if some students want to go into other fields," Mr. Taylor said. And, Mr. Britton noted, "I think we need scientific, analytical people in all walks of life."

'Ripple Effect' Seen

The school's planners and faculty also expect to have an effect on schools throughout the state. In fact, Mr. Taylor believes, it is already visible. "The school is already having a ripple effect," he said. "There are principals who are spending money on computers instead of athletic equipment. Parents are demanding it. They want their kids to get into this school."

Science laboratories and mathematical equations are important parts of life for students at the North Carolina School of Science and Mathematics, but so are mealtimes, socializing, sports, and music.

The News and Observer

Raleigh, N.C., Thursday, September 16, 1982

Durham school ranks second on merit exam

By SHERRY JOHNSON
Staff Writer

For the second consecutive year, the N.C. School of Science and Mathematics in Durham ranked second in the nation in the number of semifinalists in the National Merit Scholarship competition, according to 1983 results released today.

The Durham school had 38 semifinalists, surpassed only by Stuyvesant High School in New York City, which had 67. Wake County high schools produced 60 semifinalists.

A public specialty high school with an enrollment of about 2,600, Stuyvesant also emphasizes mathematics and science. It has ranked first in the country in Merit semifinalists for six consecutive years.

The National Merit program is the largest independently financed competition for college undergraduate scholarships in the United States. Most students who take the exam do so in their junior year.

The program's semifinalists represent the top half of 1 percent of each state's high school senior class.

"We're very pleased," said Dr. H. Braughn Taylor, development officer for the N.C. School of Science and Mathematics. "This is an indication of the high academic ability of the student body we have."

The Durham school, now in its third year of operation, has 288 students — 135 juniors and 153 seniors.

Gov. James B. Hunt Jr., who pushed for establishment of the school, praised the results and said he hoped the school could be expanded to accommodate more academically gifted students.

"This comes as good news to all of us who are concerned about public education in North Carolina," Hunt said in an interview. "These youngsters are being challenged, and they are responding."

School officials hope to raise the enrollment to about 600 over the next few years, according to Phyllis S. Frothingham, assistant development officer.

"We turn away so many good kids because of limited space," she said in a telephone interview. For example, more than 600 students were interviewed for this year's entering junior class and only 175 could be admitted, she said.

Students are selected on the basis of test scores, academic records and interest in science and mathematics. There is a heavy emphasis on personal interviews.

Those accepted are among the state's most academically gifted. The median score posted on the Scholastic Aptitude Test by members of the current senior class was 570 on the verbal section and 620 on the math section — a composite of 1,190. The maximum possible score on the test is 1,600.

Hunt also praised the school for the impact it has had on math and science teachers in the state's public schools.

For the past two summers, the Durham school has conducted workshops on the use of microcomputers for public school teachers. Under a grant from the Mary Babcock Reynolds Foundation, the school also conducts a program that has brought four public school teachers to the Durham campus for the year.

In order to become a semifinalist, students must score well on both verbal and mathematics sections of a National Merit qualifying test.

Fewer than five of the Durham school's 160 students eligible to take the Preliminary Scholastic Aptitude Test/National Merit Scholarship Qualifying Test in 1981 did not take the exam, according to Ms. Frothingham.

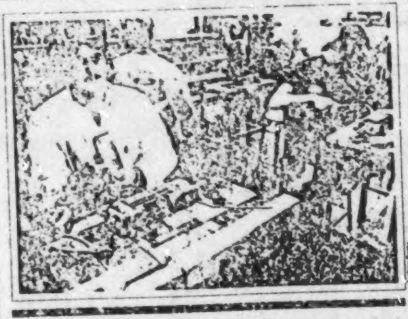
The National Merit Scholarship Foundation of Evanston, Ill., a non-profit organization, has conducted the scholarship competition annually since 1955.

A total of 15,000 semifinalists were chosen from the more 1 million students in 18,000 high schools who took the in 1981 when most were juniors.

About 90 percent of the semifinalists are expected to qualify as finalists. Merit scholarship recipients will be chosen from this group of 13,500 finalists. A total of 5,000 Merit Scholarships in three different categories will be offered in 1983.

Each semifinalist who becomes a finalist must be fully endorsed and recommended for the scholarships by the high school principal, demonstrate high academic standing through records submitted by the school and substantiate high performance on the qualifying test with equivalent scores on another exam.

N.C. School of Science and Mathematics — Robert J. Alexander, Diane A. Barber, Andrew R. [illegible], Mark E. [illegible], Madeleine C. [illegible], Marina C. Bonaventura, John C. Broughton, Stephen D. Burgess, Karen C. Burgin, John D. Cason, Robert L. Carlson, Michelle M. Chase, Annie M. Clements, Mary S. Cox, Maureen A. Coyle, Robin J. Cunningham, Darren L. [illegible], Regina L. Dobson, Lee Ervin, Adam F. Falk, Ernest L. Flake, Adrian L. Flanagan, John E. Fox, Margaret N. Golding, Barbara L. Goldman, Stephen M. Harmon, Andrew J. Hill, Carl A. [illegible], Steven D. [illegible], Robert D. Kennedy, Hih Song Kim, Kenneth S. Koh, Timothy B. Lacey, William M. Lamb, David E. Lowe, Eric D. McAfee, Melissa R. McDonald, Clifford W. Mercer, Christopher L. Middleton, James E. Miller, Nathaniel E. Miranda, Stewart T. Morgan, James M. Pittard, Timothy A. Porter, Dana E. Sackett, [illegible] Sabalis, Lisa C. Simons, Sidney E. Stafford, Christine A. Stanley, Mary Margaret Starbuck, Bryan H. Stephenson, Andrew R. Sutton, Martin Trivett, Lynne-Corinne L. [illegible], Brian P. Wolf, Sherry L. Waters, Charles H. Weber, Susan S. Woodhouse.



Bill Kwiecien, 22, is rare among the hundreds of thousands of jobless workers in Detroit: he is confident he has a future. Not long after he was laid off from his assembler's job at Ford Motor Co., he discovered a state-run training program for specialty welders. He quickly signed up. Now he's studying welding, blueprint reading and math four hours a day at Henry Ford Community College and will graduate in December. "I may not get a job the day I graduate, but I'll get one a whole lot faster than I would without this," Kwiecien says. "Retraining me makes sense. It's sure cheaper in the long run than putting me and my wife on welfare."

the importance of the link between industry and government retraining programs. North Carolina cooperates closely with present and prospective employers (box). And when five Boston-area hospitals realized they needed medical secretaries, the city's economic-development agency began a program to fill the gap. Several agencies put up $2,800 per student for a 28-week program to teach 40 unemployed people typing, language skills and medical practices and jargon. In Philadelphia, the city's employment office regularly meets with business leaders to discuss where it should invest its training funds. The city now trains roughly 30,000 unemployed a year for jobs that need filling and regularly places 72 percent of its graduates. In a typical case, 300 auto-chassis makers at the Red Lion Budd plant learned the art of

making railroad cars. Instead of being laid off when Budd phased out its automaking, they simply transferred into the company's railcar factory.

Training programs often help companies as much as they help the unemployed. One Boston project, Transitional Employment Enterprise, Inc., arranges on-the-job training for hard-core jobless—welfare mothers and the mentally retarded—in banks and insurance companies. Since both industries have turnover rates of 25 to 100 percent annually in entry-level jobs, their retraining costs are extraordinarily high. TEE's grads tend to stay—just what the businesses need. Ninety percent of those hired by Boston's First National Bank, for instance, were still working there after one year. The agency helps defray expenses by charging the companies for the trainees and places 80 percent.

Despite such success stories, the shift of jobs between industries will still leave many workers out in the cold. Older employees will retire early, scraping by on odd jobs or savings until the social-security checks come through. For these people, says Samuel Ehrenhalt, regional commissioner of the Labor Department's Bureau of Labor Statistics in New York, "there is no easy bridge to communications and computers." Even for young workers, the transition isn't easy. But training programs help. And if educational institutions—from primary schools to vocational colleges—can turn out graduates who are smart enough and flexible enough to benefit from that training, it may help alleviate the pain of structural unemployment.

SHARON BEGLEY with PHYLLIS MALAMUD in Boston, JOHN CAREY in New York, KIM FOLTZ in Detroit and RICHARD SANDZA in San Francisco

Matching Skills to the Jobs

Which comes first, the job or the skill? In North Carolina, state officials believe education is crucial to attracting industry—but without new companies, better education won't be affordable. So Gov. James Hunt Jr. is both wooing high-tech firms and aggressively improving the state's educational system. "For many industries, that's the go or no-go in deciding to relocate here," says Larry Blake, president of the state's community-college system.

The state's universities are a strong lure, but millions of dollars are budgeted for science education in secondary schools as well. The show piece is the North Carolina School of Science and Mathematics in Durham, a public residential school for 11th and 12th graders. The 385 students, admitted on the basis of SAT scores, grades and recommendations, must enroll in math every semester and cram physics, chemistry and biology into two years. They must be proficient in computer programming (the computer center is open every night until 10) and can fill out their schedule with genetics or biochemistry. The teachers, more than half of whom have Ph.D.'s, are clearly earning the 15 percent they make above the state scale: the first graduating class last May had the second highest number of National Merit semifinalists in the country.

Since a scientific elite is unlikely to have much immediate impact on North Carolina's 9.8 percent unemployment rate, the state also offers a unique retraining program. When a company moves to or expands within North Carolina, state and company officials confer on what skills are required of employees and how best to teach them. Then community colleges retool—at no cost to the company—to churn out skills the industry "ordered."

Of course, none of this comes cheap. But the best proof that it's working is the number of new companies relocating in North Carolina: more than half the Fortune 500 companies now have at least one manufacturing plant in the state—and have brought at least 150,000 new jobs with them.

nationwide response

A Lesson for D. C. Schools

The Washington Post – Editorial – November 4, 1980

The North Carolina experiment provides: a place within the public school system where students with promise and motivation can be challenged, the chance to win back the students and parents who have given up on the public schools and, above all in this city, the opportunity for minority students to have a crack at an education as good as can be found at the most expensive private school. Perhaps by the time the North Carolina State School of Science and Mathematics graduates its first alumni, the District school board will have recognized these simple truths.

Boarding School for "Brains"

Time Magazine – October 27, 1980

Educators at North Carolina's school for the gifted share a growing concern that the nation's most talented students are being neglected. Though it was attacked as elitist by some educational officials in North Carolina, the school managed to win endorsement from the state legislature. Recalls the Governor: "I pushed it because I'm concerned about the loss in productivity in American industry and the loss of our competitive edge in the whole technological field. At the high school level, we simply are not doing the best job we can do."

Science – Math School: Will excellence be contagious?

The Charlotte Observer – May 23, 1980

The students will surely find the program exciting and liberating, that is not the only goal. For the state (which is providing the basic budget) and for the private industries and donors (whose gifts will make possible the faculty supplements and so forth), the program is an investment in tomorrow's leadership. From the work–service requirement to the off–campus study, students will be constantly reminded that science exists in society. The hope for the new school is that it will make quality not only available in North Carolina, but contagious.

Math School Ranks 2nd in Nation on Merit Test

The Durham Morning Herald – September 17, 1981

The North Carolina School of Science and Mathematics has ranked second nationally in the number of semifinalists in the 1982 National Merit Scholarship competition. The residential high school had 43 semifinalists and ranked second to Stuyvesant High School in New York City, which had 53 semifinalists. Stuyvesant has ranked first in the country for five years. The semifinalists, determined by scores on the 1980 Preliminary Scholastic Aptitude Test/National Merit Scholarship Qualifying Test, represent the top half of 1 percent of each state's high school senior class. The school, which just began its second year of operation, has 303 students -- 138 seniors and 165 juniors. A total of 142 students took the qualifying test for the scholarship.

North Carolina School Provides Challenge for 150 Brightest Students

The Atlanta Constitution - November 19, 1980

The school itself seems to be a test. In times when government reports state that most Americans are headed toward "virtual scientific and technological illiteracy," the school is a grand educational experiment striving to provide a well-rounded education, free of charge, for students with an unusual facility in the sciences. The students are "from little teeny places, going away to school." They are two years younger than college-level age, "and they've all managed to cope.

North Carolina Opens a Statewide High School for Gifted in Math

The New York Times - October 8, 1980

The School of Science and Mathematics represents a lift for the nation's gifted students at a time their special needs are being increasingly acknowledged, although educators agree that few districts in the country give them sufficient enrichment and acceleration.

Proponents, led by Gov. James B. Hunt Jr., argued that the institution could ultimately provide inspiration and teaching methods to benefit all schools. Teachers throughout the state will be invited to seminars to share in the instructional methods that the school hopes to pioneer.

The students, chosen by an elaborate process that included testing, recommendations and interviews, are eagerly participating in an experiment that many say affords them an opportunity unavailable at their hometown high schools.

A hand-picked faculty of 14, augmented by four part-time instructors for such subjects as Latin and jazz, has fashioned a curriculum that is supposed to allow students to stretch to the limits of their ability. Further, because everyone at the school is interested in science and mathematics, it is permeated by a common sense of purpose.

Math School Called Investment in "Genius"

Durham Morning Herald - October 12, 1980

Gov. James Hunt called it an "investment in our genius."

Dr. Shirley Hufstedler, U. S. secretary of education, said that "all of us around the nation feel a part of it and feel as if we have a stake in the outcome."

And Joseph Bryan, retired senior officer of the Jefferson Pilot Corp., said his and his wife's $1 million contribution "is one of the best investments [we] have ever made."

All were speaking Saturday at the dedication of the N. C. School of Science and Mathematics.

Brightest Get Place To Shine

The Boston Globe - October 22, 1980

Among the attractions for math and science students are a faculty composed almost entirely of PhDs, use of advanced texts, extensive laboratory facilities for physics and chemistry, as well as access to computer systems. Most of all, says Dr. Charles Eilber, the school's Harvard-educated director, Science and Math hopes to provide the intellectual stimulation of "a community of peers" for the young people, combined with as limitless an opportunity as possible for individual achievement."

'eachers concentrate

Bill Reeves of Guilford County and Barbara Butler of Forsyth County are among 75 teachers gathered on the North Carolina School of Science and Mathematics campus this week for a crash course in microcomputers.

— Sun staff photo by Hyman

Workshop turns tables

By TERESA DAMIANO

Bewildered stares that teachers en see on a student's face are eas- to understand now that the desk turned on teachers in class for mi- computer workshops at the rth Carolina School of Science d Mathematics.

"I can understand why some stu- nts look at me with glazed eye- lls in chemistry and physics ss," said Joyce Tice of The- sville Senior High School. "The st few days here were completely nd boggling."

But now that the informational erload has peaked, working with se computers is "like eating pea- its — once I get started I can't p," said Tice.

Tice, like the majority of 75 teach- in the first microcomputer rkshop has no previous experi- ce with computers.

The purpose of the two-week ses- n is to introduce teachers to com- ter programming; show the appli- tions of computers to science cur- ula; and review sample programs teachers will know what is good d what is bad, said Steve Davis, th instructor and program coor- nator.

Laying the informational founda- n about microcomputers is a task e school took on as part of its goal share knowledge and resources th all public schools in North rolina.

Participants pay for meals, mate- als and transportation to the hool. Money from the Fund for e Advancement of Science and athematics Education in North rolina pays for the cost of holding e workshops. Some of the teach- s commute to the school, while hers are housed in dormitories.

"We don't expect the teachers to leave in two weeks with everything they need to know about computers — this is an introductory course which can be expanded independently through computer manuals," Davis said.

The program is directed at both junior high and senior high teachers of science and mathematics. Hands-on experience is stressed in the 22 formal sessions from 9 a.m. until 6:30 p.m.

Nearly 300 teachers applied for the two sessions, so officials in the Department of Public Instruction were called to help narrow the field, Davis said.

"We tried to select a mix of teachers from rural areas and teachers who would be using computers when the school year starts in August," Davis said.

The first few days of the workshop were "tense," Davis said, because teachers were getting a lot of information. "They had to focus on what they were learning and not on what they were not learning," Davis said.

But the teacher-students have caught on quickly and are very dedicated, Davis said. "We couldn't be more pleased with the enthusiasm of this group. Many will spend their free time working out computer programs applicable to their subject area and come back at night to try it out on the computer," he said.

Chuck Roser, a chemistry teacher at Durham Academy, is already thinking about applying what he has learned to next year's teaching.

"I'm very pleased with what they're teaching us," said Roser, who had no previous microcomputer experience.

"You can do science experiments with the computer and store data that would be impractical to do manually because of the time factor," he said.

Likewise Bobbie Hardaker, a biology teacher at Durham Academy, said the quick feedback and new ideas that are generated by using a computer in science experiments makes the learning process much more exciting for the student and the teacher.

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